MAY 1 1 1936

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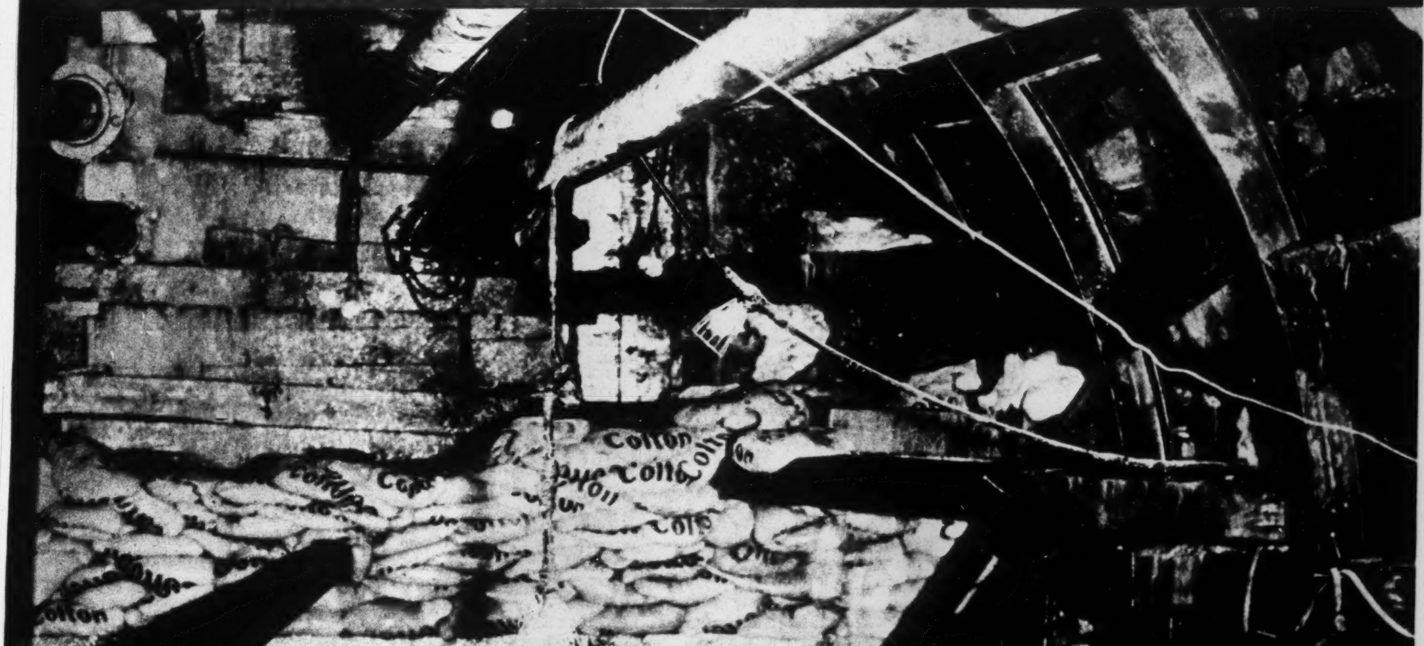
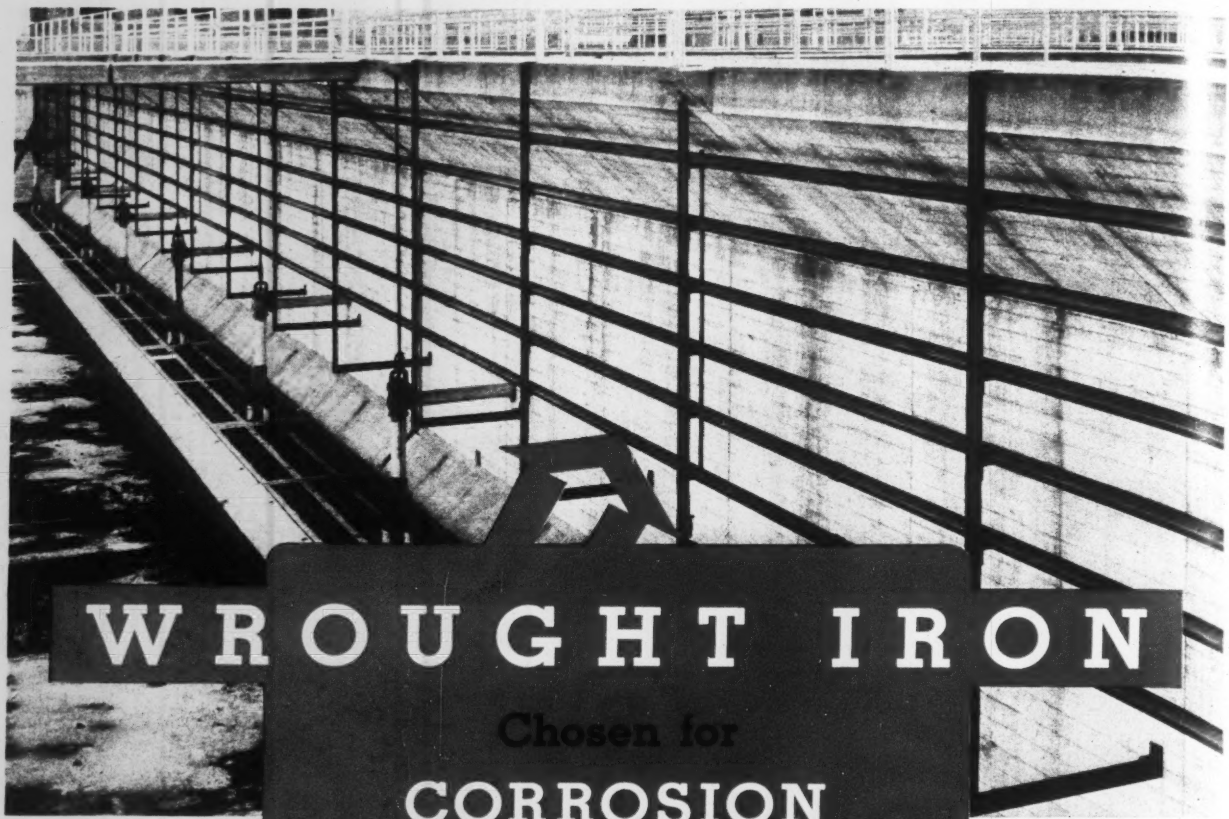


Bulkhead of sand-bags and timber to exclude water from the San Jacinto tunnel on the Colorado River aqueduct while grouting the leaking fissures. Pipes carry off the inflow while the bulkhead is being built.



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A MOMENT WITH THE PUBLISHERS

EACH to His Job—I

FROM time to time this page has spoken for private enterprise as opposed to governmental operation of productive industry and more particularly for public construction by contract rather than by day labor. It has expressed the opinion that private enterprise achieves a higher efficiency than does governmental administration, that its services cost the ultimate user or consumer less for a comparable value and that under it technical progress is more rapid and consistent; in short, that for each unit of human energy expended, the return to the community under private initiative and enterprise is greater than is possible under governmental administration.

It happens that of all the productive industries, construction is the one into which governmental units probably have entered most extensively. And now comes a reader who questions these conclusions. Himself employed in public service, he rehearses the shortcomings of contract operation, points to day-labor work that has shown creditable performance and refers to engineers in public service whose construction experience rivals that of many contractors. He denies that government-handled work necessarily is less efficient than that done by contract.

THESE observations are quite in order and deserve respectful consideration. But to clear the ground we should recognize that the operation of certain public services has passed from private to public administration because of considerations of public policy that have nothing to do with the matter of operating efficiency. Such considerations, however, do not affect construction, which should involve only the question of efficient performance.

We must recognize also that once in a great while the conditions governing some job make impracticable the award of a contract that would be fair to both the public and the contractor. In such exceptional cases day-labor operation may be fully justified.

It would be stupid, of course, for anyone to claim for private enterprise a corner on construction ability, to suggest that no public employee could become a competent constructor or to maintain that every contract job is prosecuted more efficiently than is any day-labor job. Neither would it be sensible to contend that private enterprise itself is a perfect vehicle of accomplishment, without weaknesses or abuses, or to hold that the public never is gypped by incompetent or rapacious contractors. No fair-minded advocate of contract construction will deny that some contract work is high in cost and low in quality while some day-labor work is of high grade and low cost. Belief in such absurdities is not necessary to justify a faith that we best serve the public interest when we enlist in its behalf the largest possible measure of private enterprise in preference to public administration.

The basis of that faith is not found in any monopoly of ability by those who happen to be employed in private enterprise or in any lack of it amongst those in public employment. It must be sought rather in the incentives and checks that normally inspire and dominate the two kinds of effort.

IT IS one thing to be handed a certain sum to do a job as efficiently as you can; it is quite another to be required, under pain of losing your shirt, to complete that job sufficiently within a prescribed sum to show a satisfactory profit. It is one thing to hold a position by political favor or under civil service protection; it is quite another to have no security except your ability consistently to produce satisfactory results at low cost. It is one thing to gauge that cost by certain general standards or by your own estimates; it is quite another to have it set for you on each of your jobs by the bids of your keenest competitors. It is one thing to have behind you the credit and taxing power of the city, state or nation; it is quite another to handle your job and come out whole within the limited resources of a private business.

In short, it is one thing to spend an appropriation of public funds, however conscientiously, and quite another to earn a profit in competitive enterprise.

(To be concluded in an early issue)

Willard Chevalier

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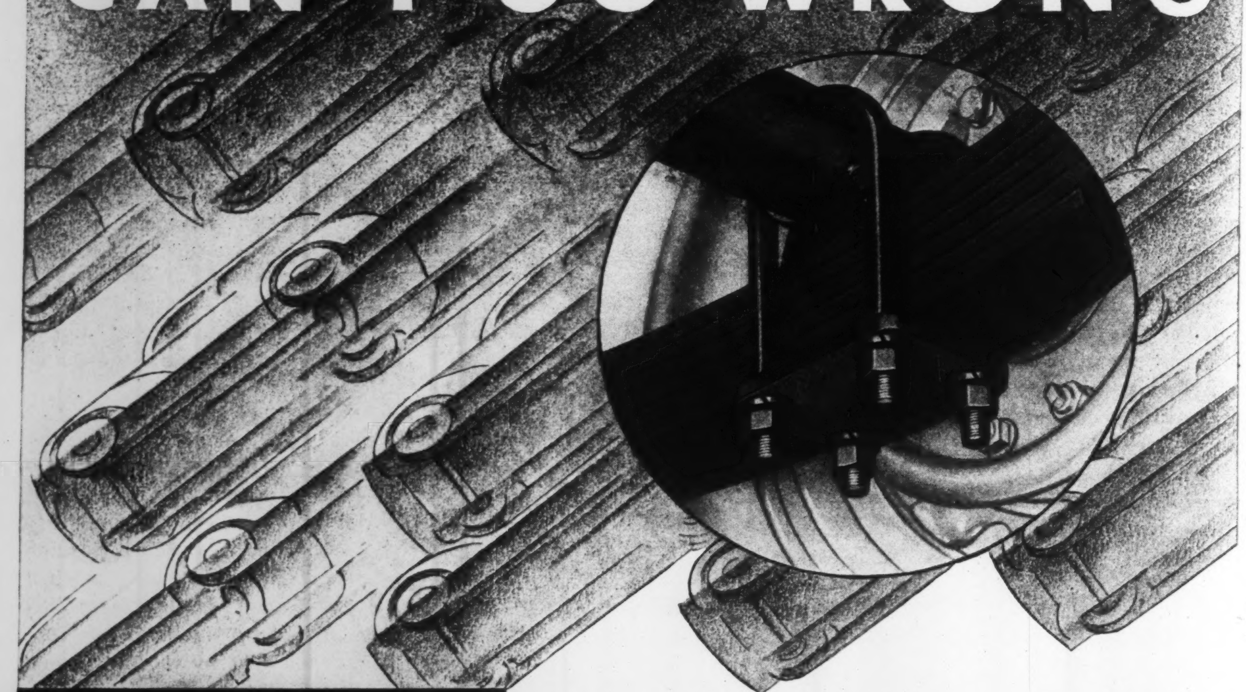
Fifty Million AXLES CAN'T GO WRONG



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Bay Bridge Articles To Be Reprinted . . . .

• Subscribers to Engineering News-Record have been privileged to read in serial form what is in effect the official engineering report of the design and construction of the San Francisco-Oakland Bridge. Some readers may not have appreciated this significant fact.

• The Ninth Chapter in This Series, whose authors are the chief engineer, the bridge engineer and the chief designing engineer of the project, is published in this issue. When finished the series will be gathered together and published in reprint form. These reprints, which will be available at a nominal price, should form a useful addition to every engineering library.

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ENGINEERING NEWS-RECORD

May 7, 1936

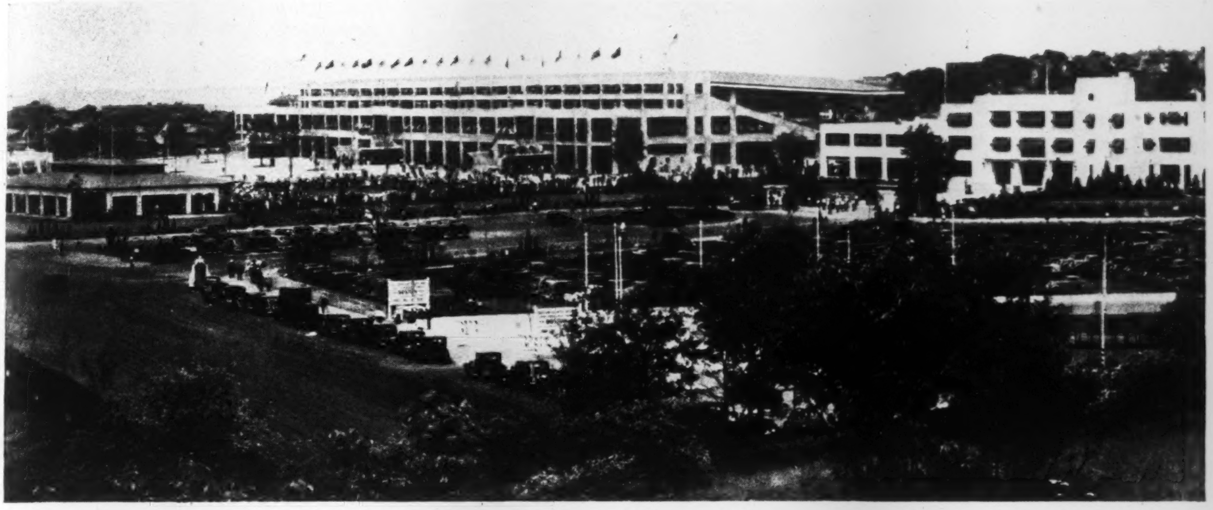

Fig. 1—Opening day at Suffolk Downs race track which was built in seventy days. View shows grandstand, clubhouse and paved approach areas.

Problems of Race Track Design

Two recent New England operations illustrate problems of free view, traffic handling and separation of elements fundamental to race track planning

By Mark Linenthal

Consulting Engineer, Boston, Mass.

A RACE TRACK is a plant for producing the entertainment of horse racing. Its elements are as complex and numerous as those of any modern industrial plant. They include the track and its appurtenances, elaborate means for housing and servicing the horses, and luxurious provisions for receiving, seating and dismissing audiences of thousands. The plant engineering involved includes drainage, grading, sanitary sewerage, water supply, lighting, roads and drives, parking areas and buildings of many kinds. Thus race tracks are comprehensive plants and in addition they are peak-load plants; they operate only a few weeks in a year and the service for which they receive pay is concentrated into a few hours a day. All means for servicing have to be keyed to peak loads.

The engineering of race tracks involves not so much difficult design of individual units as coordinate planning of a group of units. It is from this viewpoint mainly that the two race tracks are described here. Incidentally these operations brought in the problem of rapid construction which often prevails in this type of work.

The two tracks are located in New England. Narragansett Park was built by the Narragansett Racing Association, Inc., in Pawtucket, R. I., in 1934, and Suffolk Downs was built in 1935 in Boston, Mass., by the Eastern Racing Association, Inc. They are the first great modern racing plants to be built in New England, and are of interest to the engineer because they involve special features resulting from the plan, the condition of the site, the design and the speed with which they were constructed. This speed, with few or no precedents, to the writer's knowledge, gave a dramatic quality to the work. Narragansett Park was begun on June 2, 1934, and completed on Aug. 1, 1934. Work was started at Suffolk Downs on April 29, 1935, and completed on July 9, 1935.

It has been said that the bare essentials of a pari-mutuel race track are the racing strip and the betting booths. Although these features offer some problems, the major problems, from the engineer's standpoint, are concerned with what might be considered the less essential parts of the plant from the racing point of view. They consist of a grandstand, club house, administration building, paddock, stables with the mess hall and other buildings in connection with them, judges' stand, odds and totalizator boards, jockey board, miscellaneous track structures, along with the drainage system, roads, fences, planting, etc., which tie the various parts together and make them a unified whole.

Vision and traffic are main problems

The planning of a race track consists largely in the solution of two problems: the first, a problem of vision and the second, a problem of traffic handling. The problem of vision is briefly: so to arrange the grandstand, club house and standing spaces in front of them, that

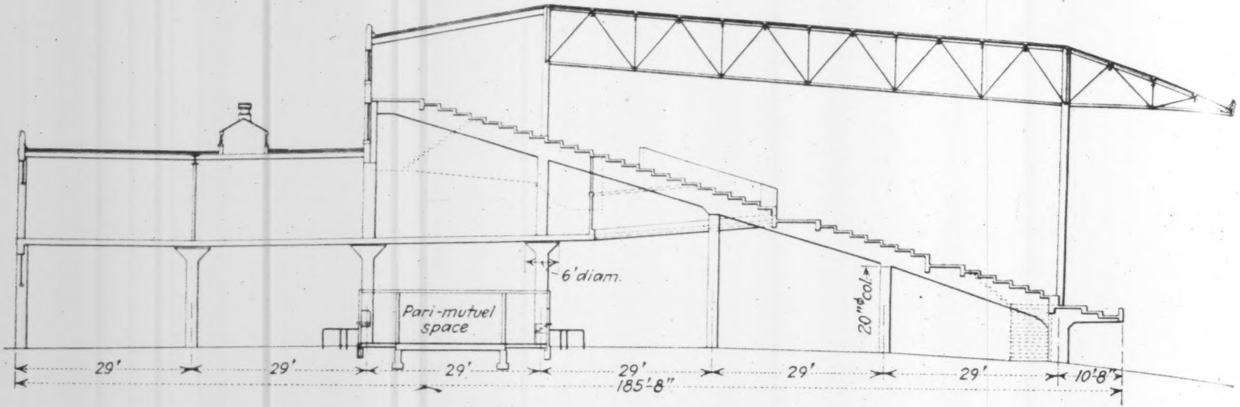

FIG. 2—CONCRETE AND STEEL grandstand at Suffolk Downs race track is 800x 185 ft. and seats 11,000 people.

all the spectators will have a clear and unobstructed view of the entire race course. The factors involved in a proper solution are the slope of the standing spaces, the rake of the grandstand and of the club house verandas, the angle which the grandstand and the club house make to each other and to the line of the home stretch.

Like most special problems of site lines, this one is best handled by the method of trial and error. A perfect solution, in the writer's opinion, is impossible because any practicable arrangement of club house and grandstand will, of necessity, involve the obscuring of some part of the track from the upper corner of the grandstand on the end nearer the club house. A good solution will minimize this defect. The accompanying plan and section of the Boston race track will indicate a solution that has been tried out in practice and has demonstrated enough success to meet with the approval of race track managements.

Handling traffic

The second great problem in planning is the handling of three kinds of traffic, pedestrian, automobile and horse. Incidentally, but of no less importance, there is need for provision for railroads, street cars, buses, etc., which may be available for handling people and horses to and from the track. By far the largest proportion of spectators at the race tracks in these days come by automobile. Thousands, however, come by railroad to such tracks as Narragansett Park, and even more thousands come by street car to Suffolk Downs, which is located in the city of Boston. The bus traffic, also, is large enough to merit consideration. The horses are transported to and from the track by railroad and by auto van.

The writer is unable to offer any general rule for the solution of the problem presented by these traffic needs. Here again the method of trial and error on the drawing board seems to be the only practicable one. In making these trials there are a number of requirements which it is well to bear in mind. Most of the people who come to the race track go to the grandstand. Entering the plant, they come in more or less gradually, but they all want to leave at the same time. The thoroughbred race horse is a highly nervous animal and as far as possible should be isolated from the crowd, except during the parade from the paddock to the course. The attendants need freedom from the crowd as well as do the horses. The jockeys should, as far as possible, be kept from contact with the public during the racing hours. Accidents may occur to spectators and jockeys. Objectionable persons must be quickly and quietly removed.

To meet these requirements, it follows that the roads should be wide, parking spaces should be laid out generously, stations for trains and street cars and buses should be placed as close to the grandstand as conditions of the site permit. The stables should be located to permit the easy receipt of horses and supplies, easy access to the track and isolation from the public. The jockeys' quarters should be located as close as possible to the paddock where they mount the horses. There must be easy and quick approach to the first-aid room and the police station without too much publicity.

In seeking these objectives, one is naturally governed to a very considerable extent by the location of the adjacent railroad lines, streetcar lines and main highways. Thus, at Narragansett Park a main line of the New York, New Haven & Hartford R.R. ran adjacent to one of the property lines. It was able to serve the stable area directly, and permitted the construction of spur passenger lines terminating very close to the foot of the grandstand. At Suffolk Downs, on the other hand, the nearest railroad line was so located that it was impossible to run a branch directly to the stable area, and the location of roads made it necessary to place the railroad station some distance from the grandstand. Political consideration prevented the construction of a street railway station at the foot of the grandstand and forced its location below the club house. The plan of the track will show the arrangement that has proved practicable in actual operation.

Site determines details

The condition of the site affects the detailed planning of the structures and may greatly affect the economy of construction of the whole race track. At Narragansett Park good foundation material was found immediately below about 1 ft. of top soil. The top soil was eminently suitable for a racing surface; good fill was available on the lot, and the only objectionable feature of the plot, a pond between the stable area and the track, was avoided in the planning. This, of course, led to a very considerable economy in the construction.

Suffolk Downs presented an entirely different picture. Originally a mud flat, it was used as a dump for every possible kind of material. Dumping had ceased from five to fifteen years before the construction. As a result, a good deal of the dump material was pretty thoroughly disintegrated and a considerable amount of compacting had taken place. Good bottom, suitable for foundations, lay from 60 to 100 ft. below the finished surface. A tidal inlet controlled by tide gates drained a large area above the track property, and had to be kept open and free during the construction and after. This tidal inlet crossed the parking area and roads and the course itself.

To meet the foundation situation, composite piles were used under the club house, grandstand and administration building. They are of timber below the water line and concrete above. The paddock structure consists of a plank and timber roof supported on masonry piers, which rest on spread footings placed on the original fill. The stables are supported on the new fill. To date, none of the structures show any signs of differential settlement except the stables, and as these are entirely of wood and the settlement is relatively slight, no damage has resulted, and it has been a simple mat-

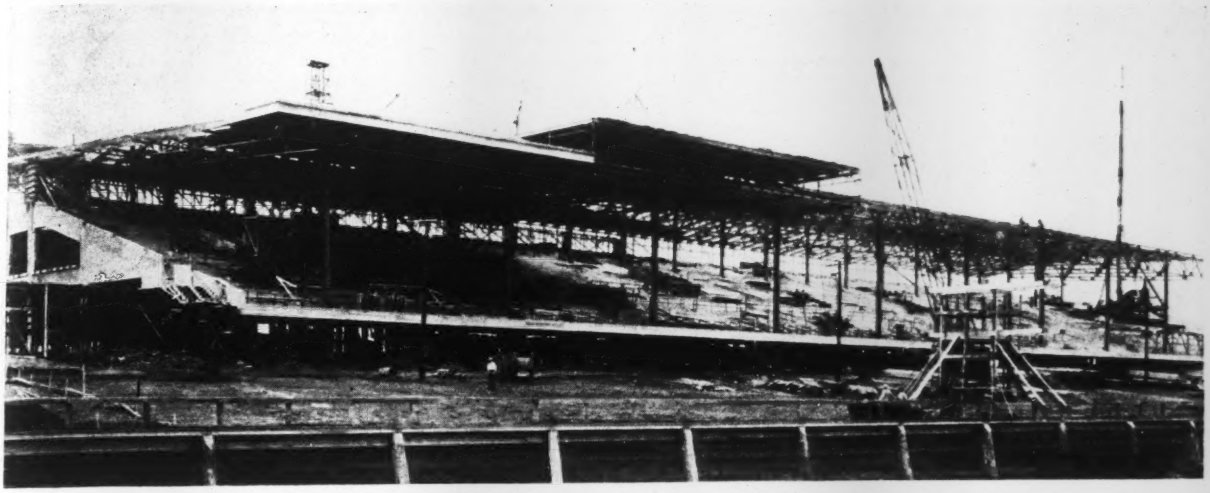

FIG. 3—RAPID construction demands dictated design of the grandstand, a concrete deck roofed with steel.

ter to level them where settlements have occurred.

To keep Belle Isle Creek, the tidal inlet, open, a corrugated steel pipe culvert 105 in. in diameter was installed in three sections, one where the creek passed under the road and the other two under the racing strip. The first two sections were cofferdammed, excavated to proper grade, backfilled with a cushion of sand and gravel and the big pipe approximately 225 ft. long was assembled. The section of pipe was then rolled into the ditch. This was accomplished with steel cables and trucks pulling from the opposite bank. The operation was entirely successful and proved comparatively economical.

Unlike Narragansett Park, a suitable top fill for the racing strip at Suffolk Downs had to be sought far afield. An intensive hunt for suitable sandy loam free of stone was carried on and the nearest available material that could be economically handled was found in Lexington, Mass., entailing a haul of about fifteen miles. The various cuts and fills on the lot were planned to balance but, on account of the character of the material available on the lot, a great deal of sand and gravel had to be hauled in to provide a suitable base for roads, pavements, etc. All of this material was hauled one to five miles.

Structures designed for quick erection

Although the conditions of the site determined the treatment of the foundations of the heavier buildings, they had no effect on the determination of the superstructures. These included the comparatively heavy grandstand, club house and administration building and a host of light timber structures.

Three alternative designs for the grandstand were considered: (1) a structure entirely of steel and timber; (2) a wood plank roof on a steel frame with the balance of the structure a steel frame and concrete slabs, and (3) a wood roof on a steel frame with a reinforced concrete structure below.

At Narragansett Park economy and speed dictated the selection of the first type. At Suffolk Downs this type was discarded immediately in favor of the second, the advantages of concrete treads over wood treads more than offsetting the small additional cost. It was first anticipated that this type would be used at Suffolk Downs, since, in the opinion of the designer, the additional cost of a reinforced concrete structure was not warranted. However, when the matter of time was considered, it was found that the very best deliveries which would be guaranteed by any of the steel companies for a steel frame would result in the complete erection of the steel frame about two weeks later than it was estimated a reinforced concrete structure could be erected.

A reinforced concrete stadium could be started immediately after the foundations were ready and before they were all completed, as against waiting for structural steel to be fabricated and shipped. There was some question about the effect of bad weather on the possible saving, but it was considered that even with the worst weather that might be anticipated no more than the two weeks would be lost. In addition, there was the advantage of being able to work under the seated portion of the grandstand and mezzanine within a few days after concrete was poured by using high-early-strength cement.

As the job was actually built, nearly the entire two weeks were saved, and only this possibility of starting the plumbing and other work under the seating very quickly made the completion of the plant possible. Although the grandstand itself was a rough structure, it had to provide enough plumbing to take care of an ordinary small town, electric lighting, the electricity for the totalizator machine, the betting booths, restaurant, rest rooms, etc. This will give some idea of the need of beginning work upon these items as soon as possible after beginning the construction of the grandstand proper.

There are some rather unusual structural details in the grandstand. There is no diagonal bracing, and the transverse bents take the wind load as rigid frames. The combination of reinforced concrete and structural steel, with the concrete work well on its way before the arrival of the steel, involved provision for receiving column bases designed for large restraint, and details anchored into the exterior concrete columns to receive steel beams. Simplicity was the aim in these details.

In the club house an entirely different problem was presented. A race course club house is essentially a large reviewing stand containing, in addition lounges, restaurant, kitchens, toilet facilities, offices, etc. These auxiliary rooms are all highly finished and completely furnished and compare favorably with similar rooms in any modern club house or hotel. Even a fully automatic electric passenger elevator with a cab and doors of the most modern design was included, no mean accomplishment in such a limited time. In addition to speed, construction was required which would not shrink and open up cracks in the plaster and in the panelled and tiled walls.

With these considerations in mind it was decided at Suffolk Downs to use a bolted steel frame with rolled steel joists closely spaced, except on the roof where wood joists were used. The rough floors are 2½ in. concrete slabs and the roofs are wood boarded. In the rooms the slabs are covered with finished flooring; outdoors, they are exposed. To date no cracks have appeared either in the slabs or in plaster or the panels. When it is considered that the footings on the concrete piles were begun on May 27 and that the building was ready for use including not only the structure but the plumbing, the kitchen, the restaurant, the furniture, etc., on July 10, the wisdom of the choice of material may be judged.

The administration building is sub-

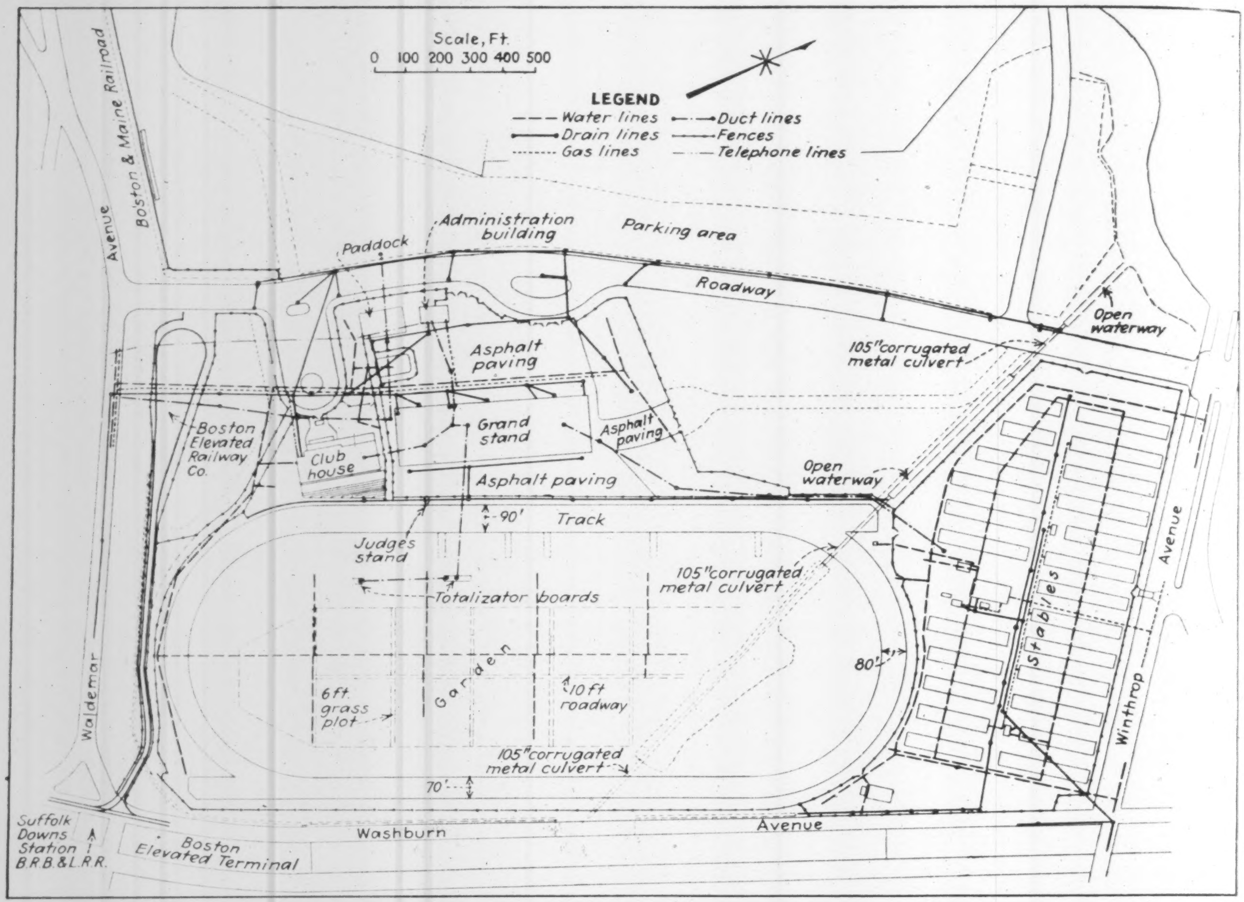
Scale, Ft.
0 100 200 300 400 500
LEGEND
Water lines
Drain lines
Gas lines
Duct lines
Fences
Telephone lines
Boston & Maine Railroad
Avenue
Administration building
Paddock
Parking area
Roadway
Open waterway
105" corrugated metal culvert
Asphalt paving
Grand stand
Asphalt paving
Boston Elevated Railway Co.
Club house
Asphalt paving
Open waterway
90'
Track
Judges stand
Totalizator boards
105" corrugated metal culvert
Stables
Avenue
Winthrop
80'
Waldemar
Garden
6 ft. grass plot
10 ft roadway
105" corrugated metal culvert
70'
Washburn
Avenue
Suffolk Downs Station B.R.B.&L.R.R.
Boston Elevated Terminal

FIG. 4—STRUCTURES and services of Suffolk Downs race track call for drainage, water supply, roads, lighting system and building construction sufficient for a small city.

stantially a small office building and is finished as such a building ordinarily is, with plastered surfaces and wood trim. At Suffolk Downs, it was built with masonry bearing walls and steel beams supporting plank floors. In this way the shrinkage due to drying lumber was minimized and at the same time reasonable economy in construction was maintained.

The paddock is a large open shed. It was built with masonry exterior piers and spandrels to match the other structures and with a heavy timber and plank roof. It was thought that, with an articulated frame of this sort, any differential settlement in the foundations would only cause cracks between the supporting piers and the spandrels and that it would be simpler and more economical to repair such cracks once or twice than to provide pile foundations. To date no evidence of settlement has been observed.

The stables are light wooden structures; this construction being chosen for the sake of economy. The fire risk is minimized by large spacing between structures and the elimination of any open flames by the use of electricity for lighting and gas for the heating of hot water, of which a large amount is required. The other buildings in the stable area of Suffolk Downs, such as the mess hall and equipment building, are all wood on spread footings carried to the original fill. To date no signs of settlement have been observed in them.

Of the track structures, the only ones that afford any special problems are the judges' stand and the jockey board. The others are simple wooden stands for starters, patrol judges, timing posts, etc. The stands are so small and light that in some cases they are made portable. The judges' stand is of glass and wood; the only resistance to wind is provided by the columns, which are carried down and built into the foundations. At Suffolk Downs, the entire bottom is designed of reinforced concrete like a box with an open top to prevent any relative movement of the parts in case of settlement, since the foundations rest on the old fill. To date no settlements have been noticed in any of these minor buildings.

Volume of work large

A complete drainage system of the roads and the track and plumbing systems for all of the buildings had to be installed along with the necessary sewer, gas and electric connections, and parking space for the 8,000 to 12,000 automobiles had to be provided as well as a complete system of landscaping. At Narragansett Park it was necessary to run approximately 1,000 ft. of 20-in. diameter new sewer line outside the property, and a new 8-in. water supply for the same distance. At Suffolk Downs, the sewer connection for all but the stable area buildings was made to a line at a much higher level than the buildings. This necessitated the installation of dual pumping equipment and a pump house and provision for an emergency discharge.

MATERIALS QUANTITIES REQUIRED

Earth Work	
Cut and fill	536,295 cu.yd.
Ordinary borrow	78,706 cu.yd.
Gravel borrow	128,410 cu.yd.
Piles	1,820
Underground piping	38,198 ft.
Stables (1,200 stalls)	
1 Mess hall	
1 Equipment building	
1 Grandstand	
1,750 M f.b.m. lumber	
1 Grandstand	
Size	600x184 ft.
Concrete	8,342 cu.yd.
Reinforced steel	696 tons
Form work	300,000 sq.ft. (contact area)
1 Clubhouse	250x90 ft.; 3 floors
1 Administration building	90x55 ft.; 2 floors and basement
1 Paddock	136x80 ft.; 1 story
1 Judges' stand	
Fencing	4¾ miles
Sheet asphalt	48,585 sq.yd.
Roads	69,100 sq.yd.
Parking areas	187,560 sq.yd.

This brief description gives a fair idea of the work required at racing plants. The statistics above, for Suffolk Downs, may further clarify the picture.

This lists the more outstanding items of a complete plant. It does not include the railroad connection constructed by the Boston & Maine R.R. Co., nor the station outside the grounds built by the Boston, Revere Beach & Lynn R.R., nor the loop station built in the grounds by the Boston Elevated R.R. Co.

To do this amount of work in the time, with incomplete plans to begin with, no general contracts for the entire jobs were possible, and complete control by the engineer of all design, architectural and landscaping and interior decorating as well as engineering and construction was essential.

The various parts of the work were let to different contractors. Whenever possible, and in general it was possible, they were let on a lump sum basis, and the whole coordinated and supervised through the engineer's office. Without such coordination, without one place where decisions could be made quickly and authoritatively, the progress attained would have been impossible.

Economic Aspects of Skyscrapers

In outlining the development of skyscraper buildings, particularly in Chicago, a paper presented at the annual meeting of the Illinois Society of Engineers, by Albert Smith, consulting engineer, Chicago, pointed out that in spite of the handicap of soft soil an outstanding generation of Chicago designers and builders brought about a great development in the art: "W. L. Jenney, D. H. Burnham, W. A. Holabird, Louis Sullivan, C. T. Purdy, C. A. Strobel, E. C. Shankland, L. E. Ritter and Wm. Sooy-Smith had vision to see new heights and the courage and skill necessary to surmount them." Mr. Smith suggested also that "Some writing engineer should spend about two years accumulating data and preparing an orderly readable history of this great development." An abstract follows of that part of his paper relating to present conditions.

The development of the 25-story building is more important than the increase in heights from 25 to 100 stories. From the special column sections (Phoenix, Keystone and Larimer) engineers changed to the box and I-columns built up of plates and angles. About 15 years ago the mills began rolling I-sections so heavy that the columns of a 25-story building could be ordered from the mill, and required only milling and splice plates and beam connections in the shop. Even where thick coverplates are riveted to these sections there is much less shop work than was required for the plate and angle sections, and we can now make a column section capable of carrying 2,000 tons by adding coverplates to the rolled sections. For an average story load of 70,000 lb., this means that we reach nearly 60 stories in office buildings without fabricating special columns. The heaviest columns of the Empire State Building have an area of 684 sq in. and carry 10,000,000 lb.

Ingenuity is required to make the simplest form of fabricated column that will receive conveniently the rivets attaching floorbeams and brackets. It is easy to imagine a collection of sections which could not be driven. Any diagram of heavy columns is interesting, because the designer worked within these restrictions.

It is probable that structural welding will make it easier to put together proper sections of area much larger than any we have yet built, and it is conceivable that we could build columns that would carry as many as 150 stories. However, the upper-height limit of buildings is not determined by the engineer, but by the rental agent. The highest New York buildings are: Empire State, 86 rentable floors, 1,250 ft.; Chrysler, 70 rentable floors, 1,045 ft.; Manhattan Bank, 70 rentable floors, 927 ft. The highest Chicago buildings are: Board of Trade, 45 rentable floors, 620 ft.: Field, 42 rentable floors, 535 ft.; 1 LaSalle St., 42 rentable floors, 530 ft.

Ground area limits height

In Chicago, above the 264-ft. point, tower floor areas are limited by law to 25 per cent of the ground area, and the total volume of such towers is limited to one-sixth of the volume permitted below the 264-ft. point. This means that a building erected on a lot 200x200 ft. might have a tower 100x100 ft. and a total height of 440 ft. If the tower area were less than 10,000 sq. ft., it could be carried higher. Thus, a tower 80x80 ft. could be carried to 542 ft., and if the tower were reduced in area in its upper sections, it could be carried still higher. If we could assemble a plot a block square with no alleys we might build much higher than the Empire State Building. Such plots have been planned in the air-rights section east of Michigan Blvd., but elsewhere 200x200 ft. is the largest plot that can be assembled without securing a special ordinance.

If the tower section of a proposed skyscraper has a height-over-width ratio greater than ten in the lower story, the wind stresses become very large and the structural cost is much increased. At the same time the elevators and stairs and corridors occupy an increased percentage of the gross area. The cost of the structural frame of a building varies greatly with the height and very greatly with the height-width ratios.

Structural cost

In a 20-story building with steel columns and girders and concrete joist floors, the structural cost will be about \$1.50 per sq. ft., or about 13 to 14c. per cu. ft. If we put stories above these twenty, the steel in the columns of the twenty stories is increased. It costs about 1c. for steel to carry 1,000 lb. 1 ft., and \$2.60 to carry 1,000 lb. 260 ft. For an average load (including distributed wall load) of 200 lb. per sq. ft., every square foot of floor above the twentieth story adds 52c. directly to the normal cost of the building. It would be fair to charge this added cost to the added story and to say that this factor of structural cost alone adds about 7 per cent (0.35x0.20) to the cost of tower footage. The cost of windbracing increases as the square of the height.

Elevators cost about \$1. per sq. ft. of area served. Also, the elevator which serves 25,000 sq. ft. above the twentieth floor is robbing the twenty floors below of about 800 sq. ft. of rentable space. Heating and plumbing cost more. The cost of walls per square foot of floor is much greater in the tower.

These are some of the elements which cause the cost of Chicago office buildings to vary from 50c. to \$1. per cu. ft. The floor of a 20-story tower on a 20-story main building will cost 25 per cent more per sq. ft. than the square footage in the stories below, and that cost must be borne by a net rentable area whose proportion of the gross is only about 75 per cent of the proportion for the floors below.

These figures are rough and merely illustrate a manner of arriving at the economic justification of a tower. If rentable area in the tower costs 33 per cent more than rentable area below, you must rent the tower space for 33 per cent more than the lower space. In some towers, during the boom period, much higher rents were paid for tower space, but it is the opinion of rental agents that no tower in Chicago pays its proper share of interest on the investment during the most prosperous times, and that the tower contributes a disproportionate share of the loss in bad times.

The skyline of a great city is a very interesting sight. Much has been written of the emotions of the beholder. Engineers are essentially poetic, and they have this added thrill which the layman misses. They know that the owner of each high tower has invested large sums on which he cannot expect fair interest in return, and must take a large part of his payment in the gratitude and applause of the sightseer.

Cable Spinning on the Bay Bridge

Double-sheave spinning wheels place 128 tons of wire per day in mile-long trips between anchorages—Footbridge cables later become suspenders—Wire manufacturing technique

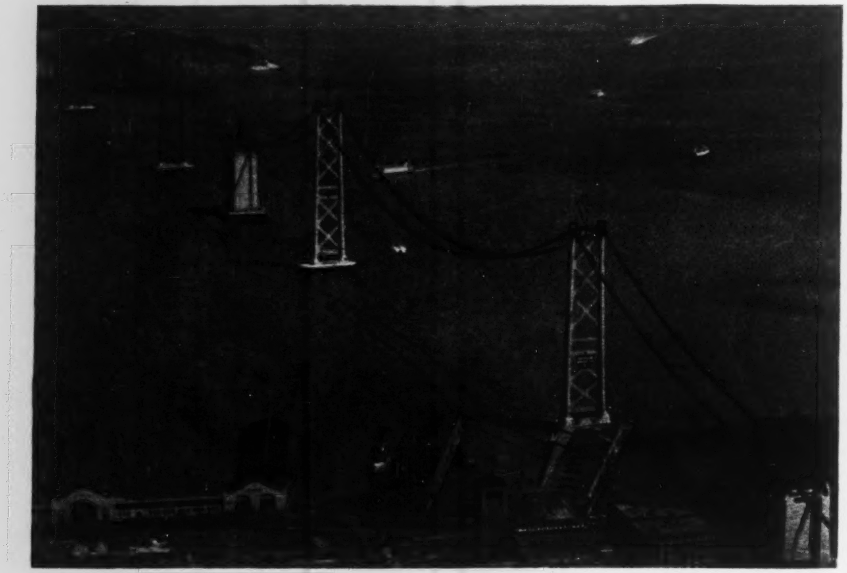

FIG. 1—TWO SUSPENSION BRIDGES placed tandem comprise the West Bay crossing of the San Francisco-Oakland Bridge. Each main span is 2,310 ft., and from end to end the two bridges are nearly 2 miles long.

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Chief Engineer, Bridge Engineer and Engineer of Design, Respectively; San Francisco-Oakland Bay Bridge

AERIAL SPINNING of suspension-bridge cables has not changed in principle since it was devised by John A. Roebling for the Niagara Falls Bridge in 1854. To meet demands for speed, contractors on each successive major structure have so developed machinery and construction details as to increase materially the rate of placement. At the same time the quality of the wire repeatedly has been improved to reach the present high standard. Instances typical of these progressive advances are cited in Table I.

The west channel crossing of the San Francisco-Oakland Bay Bridge consists of two complete suspension bridges, the east bridge and the west bridge, joining in a central anchorage common to both structures. Although the central span of each bridge is only 2,310 ft., the total distance between anchorages on opposite sides of the channel is 10,300 ft. The west bridge cables were spun first. Meantime preparatory work was begun on the east bridge and with the advantage of experience, the spinning rate was faster on the second bridge. In the following, spinning methods, equipment, connections, progress and the scope of operations generally are described. Those manufacturing processes that are of special interest are given attention.

On the Bay Bridge, specifications required the use of acid open-hearth steel for the cable wire. The melts were poured into 20x20-in. ingots which were successively rolled to 6x6-in. blooms, and 2x2-in. billets. After ends of the billets were cropped sufficiently to remove segregation and pipes, they were rolled to rods ⅜ in. in diameter. These rods were then patented by heating to 1,600 to 1,800 deg. F., quenched in a bath of molten lead from 850 to 1,100 deg. F., and finally passed through a drawback bath of molten lead at 800 deg. F. This was followed by pickling in a bath of dilute sulphuric acid and dipping in an 8 per cent lime solution, after which they were baked from 6 to 8 hr. at 300 deg. F. to remove any embrittlement.

The rods then were drawn cold through water-cooled dies (four passes) to bring them through successive decrements down to the specified diameter of 0.192 in. Before galvanizing, the wire was cleaned in an acid solution and rinsed in water. It was then run through a 5 per cent solution of hydrochloric acid which acted as a flux. This was followed by a zinc bath, maintained at temperatures from 820 to 870 deg. F. The wire was immediately wiped by running through a bed of crushed charcoal. After cooling, it was coated with wax, coiled, and was then ready for shipment to the reeling plant. The coils averaged 400 lb. or 4,000 lin.ft. of wire each.

The coils were spliced with steel ferrules into which the ends of the wires were screwed. To minimize the possibility of unscrewing, the threads on the two wires were of opposite hand and the ends of the wires beveled. Threads were swedged and the joint developed not less than 95 per cent of the strength of the wire. For splices made in the field, the threads were cut and the efficiency of the joint reduced to about 90 per cent. The contractor used reels of welded steel construction with a barrel diameter of 5¼ ft. Each reel carried about 57 mi. of wire and weighed 18½ tons when loaded.

Footbridges

Cable spinning requires an extensive amount of erection plant, of which the footbridges are perhaps the most important. They provide a working platform and support the haulage system along the length of the cable. Weight, fire hazard and wind resistance were important items in their design. All these problems were met effectively on this project by using wire mesh for the floor. The footbridges were 10 ft. wide and each was supported by four 2¼-in. ropes which later were used for suspenders. Under these ropes 6x8-in. timber floor beams were secured at 10-ft. intervals. Over these beams and under the ropes, 2-in. chain link fabric was stretched tight, and this in turn was covered with hardware cloth. The latter was turned up 18 in. along each side to act as a kick-board. Hand rails of 9/16-in. wire rope were supported by posts at each floor beam. Steel cross-bridges, 4 ft. wide, were put in between the two parallel footbridges; three in the main spans and one in each of the other spans. These cross-bridges are later to become inspection bridges, one for each span, capable of traveling along the length of and under the trusses. Two 1-in. storm cables were provided for each footbridge, stayed by 9/16-in. vertical wire ropes at 126-ft. intervals.

These 1-in. ropes will be used later as hand ropes along the main cables.

The 2¼-in. supporting ropes were erected individually in each span by means of a messenger cable; thus they escaped salt water immersion and dragging through the mud, either of which might have seriously damaged the material. The flooring was assembled in the yard in 100-ft. sections, lifted to the tower tops in bundles and then slid along the ropes to the final position where it was secured and stretched taut.

Spinning machinery

The layout of the spinning machinery at the San Francisco anchorage is shown in Fig. 2. There was a similar setup on top of the center anchorage, which differed only in details of arrangement. When cables for the west bridge were completed, machinery at the San Francisco anchorage was transferred to the Yerba Buena anchorage, and after a few simple changes at the center anchorage the contractor was ready to spin the cables of the east bridge.

At each anchorage were two reel stands, each with capacity for eight reels of wire. This was twice the capacity needed in operation but the extra space facilitated changing empty reels for full ones. The reels were mounted and locked on shafts capable of being powered or braked as desired. Power was supplied by a 30-hp. air motor mounted at the rear of the reel stand whence the operator could see all equipment on the anchorage. This power was used when accelerating the reels, but not when they were running at constant speed.

Brakes were of heavy construction, of the external contracting type and were entirely automatic in operation. They were actuated by the movement of the floating sheaves in the 57-ft. steel tower in front of the reel stand. In this tower wires from the reels were reeved through sheaves at the top and bottom before leaving the anchorage. The lower set of sheaves floated vertically in a track and thus maintained a uniform tension in the wire as it was pulled out by the spinning wheel.

The spinning wheel, which traveled the length of the footbridge, was 4 ft. in diameter and had grooves for two loops of cable wire. The wheel was supported by a ⅞-in. plow steel haulage rope to which it was attached by a gooseneck yoke. This yoke permitted the wheel to pass the sheave supports for the haulage rope which were on timber gallows frames at about 230-ft. intervals. At the tower tops a light structural steel frame carried a set of similar supporting sheaves on the arc of a circle.

Power for the haulage rope was supplied by two 75-hp. variable-speed electric motors, one at each anchorage, each provided with a motor-driven controller. These controllers were operated by pilot motors controlled in turn by a single starting switch at the center anchorage. In this manner the two power units were synchronized. Emergency switches for stopping the spinning wheels were provided at frequent intervals along the footbridges. They could be started, however, only at the center anchorage and then not until all switches along the line had been closed.

This equipment was designed for a spinning wheel speed of 800 ft. per minute, and always was able to place wires faster than they could be adjusted. The maximum speed actually employed was 610 ft. per minute.

Spinning in the tower saddles

With one or two exceptions, the practice on suspension bridges has been to spin the strands outside the tower saddles, and to lift them into the saddles after completion. On the Bay Bridge, however, the strands were spun in the tower saddles. This plan permits a simpler arrangement for the final adjustment of the strand shoes at the anchorages, and makes the usual strand legs unnecessary. The jacking equipment for this adjustment is very simple and positive. The heavy equipment for lifting strands at the tower tops is eliminated, and it is possible to reduce the width, and hence the cost, of the footbridges. On the other hand, certain difficulties are introduced: (1) There is only a small amount of clearance at mid-spans, between the strands being spun and those already completed and adjusted. (2) The movement of the strand shoes for final adjustment requires space for a relatively large number of shims and (3) the outside wires of each strand are rather severely punished unless great care is taken when the strands are reeved through the saddles.

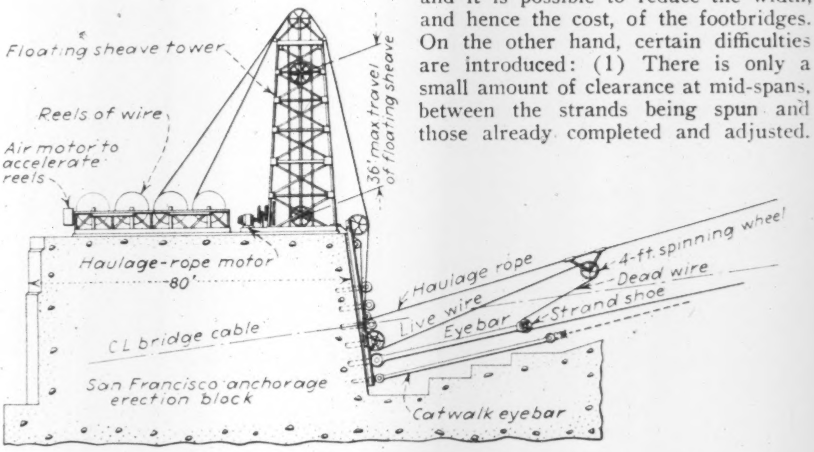


FIG. 2—ARRANGEMENT of spinning equipment at San Francisco anchorage.

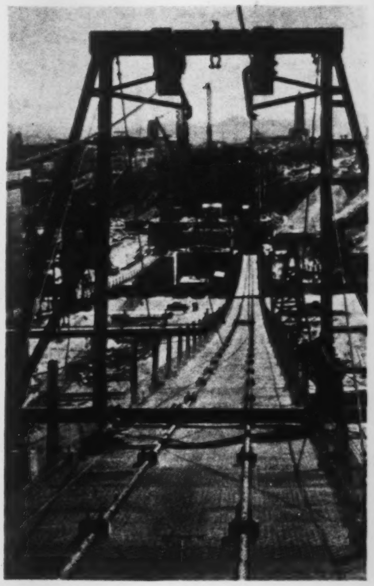


FIG. 3—FOOTBRIDGE, carried by four 2¼-in. suspender ropes, is floored with wire mesh to reduce weight and wind resistance. In foreground is timber gallows frame for suporting haulage-rope sheaves.

Except for the first four strands in each cable, the strand shoes at the two anchorages were held during spinning in a temporary position several inches behind their final location. This kept these strands 12- to 18-in. high at mid-span, and thus avoided interference between previously completed strands and those being spun.

As the spinning wheel moved out from the anchorage it carried two loops of wire. Men stationed at frequent intervals along the footbridge caught the wires by hand immediately after the wheel passed and placed the dead wires under hooks and the live wires under small ball-bearing sheaves secured to the floor of the walk. This prevented dangerous swinging of the wires and kept them sorted and identified for adjusting.

The wires were adjusted individually in each span. The observer, stationed at mid-span, was connected by push button signal with the come-along operator at the tower top. The first few wires of each strand were adjusted to an accurately surveyed guide wire. Thereafter, adjustments were made with respect to wires already in place.

Four strands were spun at a time in each cable except for the single, odd strand. There were two spinning wheels on each hauling rope, that is, wires were drawn from each anchorage simultaneously. Originally it was intended to spin 24 hr. a day but the intensity and

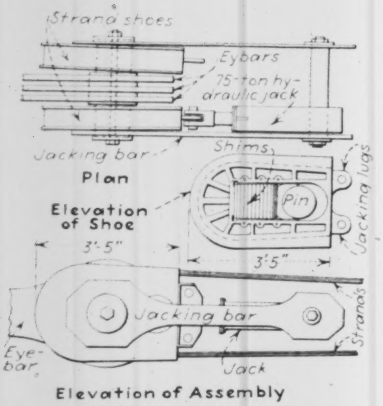


FIG. 4—JACKING BAR DETAILS showing means by which each strand shoe is moved from spinning to final position. Shims are removed as needed for movement.

direction of the afternoon trade winds made this impossible and this phase of the work could not be carried on for more than 21 hr. a day. Night spinning offered no difficulties; in fact best progress was made at night.

When all of the wires of a strand had been placed, they were shaken out to detect especially high or low wires. Any such were cut and spliced to correct length. Generally the wires all fell within a vertical range of not more than 15 in.

Before adjusting each completed strand into its proper place on the cable it was seized at 5-ft. intervals with air-operated tongs and secured with light metal bands. Adjustments were made at night; strands were lowered into position by permitting the strand shoes at the anchorages to move forward, meantime reeving the strands through the cable saddles by means of steamboat rachets. The movement of the strand shoes was controlled by a 75-ton hydraulic jack operating against the forward end of the shoe and secured to the pin by a special jacking strut as shown in Fig. 4. The shoes were held to exact position by means of shims.

The connection of shoes to eyebars was somewhat novel, and made it possible to spin the strands with the shoes in their final positions, except for the limited amount of forward movement during adjustment. Three, and in some cases two, eyebars held each pair of shoes, with the shoes outside the bars. This contrasts with the usual practice in which each strand shoe is pinned between a pair of eyebars.

During spinning a certain amount of wavy wire appeared and was rejected. It was generally impossible to detect this fault until the wire was stretched out and hanging under its own weight along the cable.

The only accident of note that occurred in spinning resulted in the loss of one strand in the south cable on the west bridge. The strand had been completed and shaken out to disclose any wild wires. The strand shoes at the two anchorages were in their spinning position back of normal. The supporting pin was thus several inches in front of the center of curvature of the rear face of the shoe about which the wires looped. This created an unstable condition and a tendency for the shoe to rotate with any difference in pull on the two halves of the strand. A light steel hold-down was placed on each shoe, but with the wires of the strand not tied together and probably influenced by rapidly changing temperature in the evening, the shoe at the center anchorage pulled away from the hold-down and rotated in a vertical plane through an angle of about 160 deg. In this position there was nothing to hold the wires in place, about half of them fell off the shoe entirely and the remainder caught on the rear square face. The slack thus created permitted the wires to reeve through the tower saddles in small amounts and the strand was generally displaced for its full length. It was necessary to dismantle the strand completely and condemn the wire.

Cable compacting

The contractor provided two compacting machines operated entirely by compressed air. These machines weighed about 7½ tons each and their principal feature was a heavy structural steel collar built to encircle the cable. Within this collar were assembled six 75-ton screw jacks, set to operate radially toward the center. Each jack was fitted with a curved steel shoe designed to bear against the cable. All jacks were operated from a common chain drive, for which power was provided by a reversible air motor. Thus all the jacks could be made to move forward simultaneously and by the same amount, although the force exerted varied from jack to jack. It was soon found that best results were obtained by adjusting the top jacks to lag behind the others by a fraction of an inch. This produced an almost perfectly round cable.

A seizing device was attached on the rear face of the collar. An annular disk with a ring gear on the outer circumference was supported on bearings around the inner circumference. This disk was rotated by an air-driven pinion engaging the ring gear. A coil of No. 9, soft-annealed, double-galvanized steel wire was held on a support attached to the disk and thus rotated with it. From the coil the wire passed between a pair of leather-lined clamping plates, adjustable so that any desired friction could be applied. Tension thus produced was multiplied by carrying the wire around a niggerhead spool. It was then deflected by a sheave to a point near the shoes of the jacks where it passed around the cable. This deflector sheave was automatically moved away from the jack shoes the thickness of one wire for each revolution of the disk. Each seizing consisted of 6 or 8 turns of wire, and the ends were secured by bending them back and tucking them under three or four wires of the cable.

The entire machine was supported by a light steel frame equipped with two laminated wood spools that traveled on the cable. It was moved forward by an air-powered winch working on a line attached to the cable on the uphill side.

The machine proved satisfactory from every angle. It produced a cable averaging only ¼ in. out of round and with but 19 per cent voids. A single passage of the machine with no preliminary compacting accomplished these results. This was made possible by placing bolted wooden collars at 50-ft. intervals in advance of compacting. In one 24-hr. run a single machine compacted and seized 1,410 ft. of cable at 3-ft. intervals.

FIG. 5—SPINNING EQUIPMENT on the central anchorage in the middle of San Francisco Bay. Cramped quarters in spite of a work platform 80x180 in size.

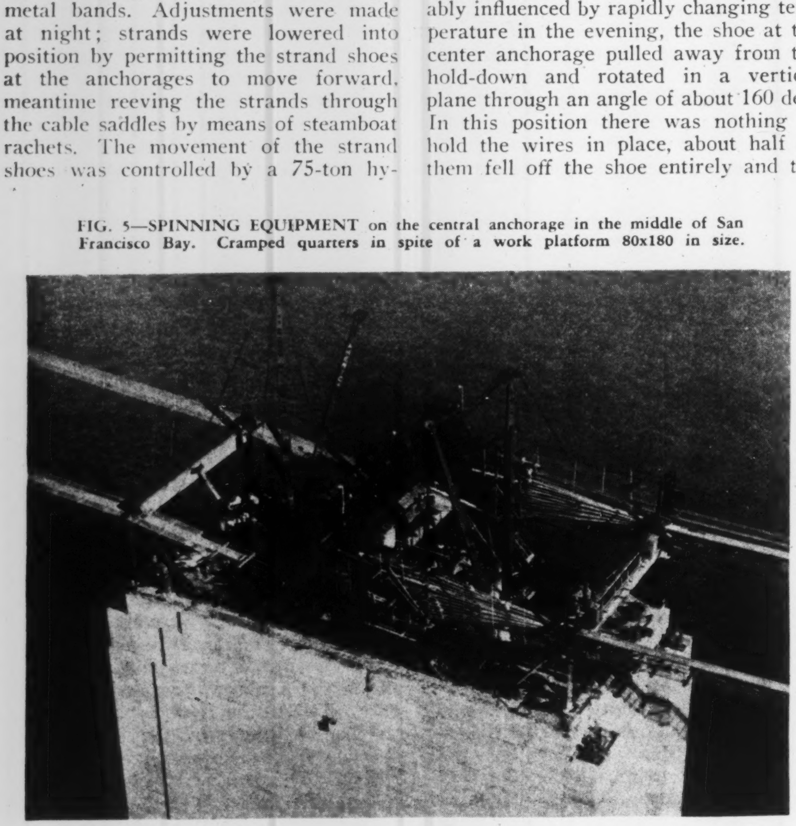


TABLE I—STATISTICS FOR MAJOR SUSPENSION BRIDGES SINCE 1854

Bridge	Year	No. of Cables	Diameter of Cables, In.	No. of Strands	No. of Wires per Strand	Tons of Wire	Calendar Days Spinning	Tons per Day	Diameter of Wire, In.	Specified Ult. Strength, Lb./Sq.In.	Aver. Ult. Strength by Test
Niagara Falls	1854	4	10	7	520	....	...	..	0.148	......	......
Brooklyn	1881	4	15½	19	282	3,780	630	6	0.187	152,000	......
Williamsburg	1902	4	18¾	37	208	4,550	210	22	0.192	200,000	......
Manhattan	1908	4	20¾	37	256	6,120	120	51	0.195	205,000	......
Bear Mountain	1923	2	18	37	196	.....	97	..	0.195	215,000	
Delaware	1924	2	30	61	306	6,800	155	44	0.196	215,000	223,000
Ambassador**	1928	2	19¼	37	218	3,097	77	40	0.195	215,000	
Ambassador	1929	2	19¼	37	218	3,097	62	50	0.195	215,000	225,800
Mid-Hudson	1930	2	16¾	19	320	2,212	91	24	0.195	215,000	
Geo. Washington	1930	4	35⅞	61	434	28,300	286	99	0.196	220,000	234,000
S. F.-Oakland	....	..	...	..	....	....	...	..	0.1955	220,000	231,000
West Bridge	1935	2	28⅝	37	472	10,240	120	85	.....	......	.....
East Bridge	1935	2	28⅝	37	472	8,860	69	128			
Golden Gate	1936	2	36⅜	61	256 to 472	21,495	*	*	0.195	220,000	

**Cables of heat treated wires removed and replaced with cold drawn wires.
*Still under construction.

Model cable

A 10-ft. length of model cable, identical in every way with the bridge cable, compacted to determine the exact diameter for boring the cable bands, was specified. The wires of the strands were placed singly, to avoid crossing, and the strands seized and banded. The strands were then laid up in a series of cradles shaped to produce the hexagonal cross section of the unsqueezed cable. Before compacting the model the ends of the strands were painted various colors so that their shape and location could be followed and identified during squeezing. The results are shown in Fig. 6.

With the model compacted, its diameter was measured and a cable band bored to fit. The band was placed and the bolts tightened to the specified tension. It was foreseen that there would be tendency for individual cable wires to be squeezed into the gaps between the two halves of the cable band as the bolts were tightened. To prevent this, one-half of the band was provided with several short "fingers" along the two edges where it was to meet the other half of the band. Recesses were cast in the second half into which the projecting fingers could fit. The detail proved satisfactory. In a second test the "fingers" were removed and a piece of sheet metal placed under the band and across each gap. This proved worthless, however, since the sheet metal squeezed into the gaps as the bolts were tightened.

Tower saddles

To bring the cables to their position with the bridge completed and all dead load in place, it was necessary to spin them as much as 18 ft. high in the main span, 22 ft. low in the San Francisco backstay and to displace or offset the saddles on top of the towers and end bents. These saddle displacements, determined by calculation, were as shown in Table II.

TABLE II—SADDLE DISPLACEMENTS DURING SPINNING

Bent No. 1	3 ft. 7 5/16 in. west
Tower No. 2	4 ft. 7 in. west
Tower No. 3	0 ft. 8 in. east
Tower No. 5	1 ft. 2 in. west
Tower No. 6	1 ft. 2 in. east
Yerba Buena bent	0 ft. 3 in. east

Bent No. 1 is pin-connected at its base, and the movement was taken care of by rotation on this pin. The Yerba Buena bent is rigidly connected to the concrete footing by anchor bolts, but during spinning these bolts were loosened to permit a small rotation about the eastern edge of the base plate. A special steel bearing plate was seated in the concrete to carry this concentrated edge load.

The 2-in. tower cap plates upon which the saddles rested were extended and supported by temporary brackets. The top surfaces of these plates were finished smooth and coated with hot paraffin. When this had hardened, a coat of white lead and tallow was applied. The bottom surfaces of the tower saddles were treated in the same manner. This made it possible to slide the casting on the cap plate with two 500-ton hydraulic jacks operating against temporary jacking brackets. This capacity was never required as the friction coefficient proved to be remarkably low. At starting, this coefficient varied from 0.05 to 0.15 and then immediately dropped to a range from 0.04 to 0.06.

On this job it was necessary to provide a new type of cable saddle which deserves mention. The saddles on the four high towers and on the Yerba Buena bent are similar to the type generally employed elsewhere, and are characterized by the stepped contour of the bed. On bent No. 1 the saddle was cast and machined to fit the circular cross-section of the cable. This was necessary because of the amount of bent movement produced by live load changes which would have caused binding of the wires in a saddle of stepped contour. The circular casting was easier to machine in the shop and it presented no field difficulties during cable spinning. In addition, the compacting and wrapping machines can operate much closer to this saddle, it is less difficult to secure a good fit of the adjacent protective hoods, and the general appearance of the finished job is superior. The inside diameter of the casting is 28⅝ in.; the top 150 deg. of arc was open during spinning. As there was no stranding here the wires fitted closely without compaction. When spinning was completed a cap casting was bolted in place.

Near the end of each cable there is a heavy steel cable casting intended to resist the bursting forces set up when the strands leave their compacted circular form to splay out to the strand shoes. In the design of these castings calculation was made of the force exerted by each strand in a direction perpendicular to the axis of the cable, and caused by the change in slope of the strand referred to that axis. The length of the casting was selected arbitrarily, and in order to distribute the forces uniformly along that length the interior surface was cast and machined as a parabola. Since the vertical splay of the strands exceeds the horizontal in all cases, the

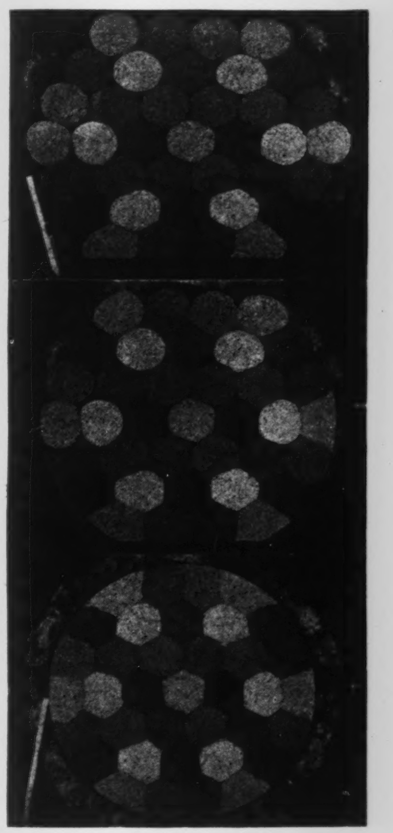


FIG. 6—SUCCESSIVE STAGES in compaction of model cable. Colored ends identify the 37 individual strands. Top, before compaction. Center, partial compaction. Bottom, compaction complete.

horizontal bursting forces per unit of length of the casting are less than the vertical when the total force is distributed over the full length in both cases. A polygon of these forces taken at any section along the casting and perpendicular to its longitudinal axis resembles an ellipse with the major axis vertical. In an effort to keep this polygon close to the neutral axis of the casting, the latter was shaped, within fabrication limitations, to fit this curve as closely as possible.

The distance of this polygon from the neutral axis measured the bending moment and thus the bending stress. To this was added the direct stress due to tension in the ring. The resultant stresses proved to be quite large, and a heavily ribbed casting shown in Fig. 9 was required. To hold the two halves together $2\frac{1}{4}$-in. special heat-treated bolts are provided.

In addition to the bursting forces acting on these castings there is a component of this load tending to push the casting along the cable and away from the anchorage. This is resisted by a cast steel friction collar held by eight heat-treated bolts and placed against the throat of the splay casting. These friction collars are similar to the cable bands.

Cable bands

The cable bands are of cast steel and not unlike those which generally have been used on similar structures. They are $1\frac{11}{16}$ in. thick and are held tight around the cable with eight to sixteen 2-in. heat-treated bolts drawn up to a tension of not less than 68,000 lb. per bolt. Tightening was accomplished with an 8-ft. hand ratchet wrench. The stress in two bolts of each cable band was determined by measuring the strain with a specially designed gage that bridged from one end of the bolt to the other. Small counter-sunk holes in the ends of these bolts provided seats for the gage points. The stress in all other bolts was established by applying a measured force to the wrench. The effect of the first tightening frequently was lost within a few days, and several repetitions of the work were necessary to maintain the desired and necessary tension in these bolts.

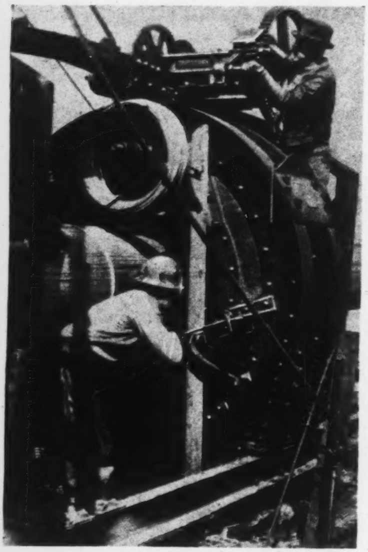


FIG. 7—CABLE-COMPACTING MACHINE in operation. This view is of the rear face, which shows rotating mechanism for placing seizing wire.

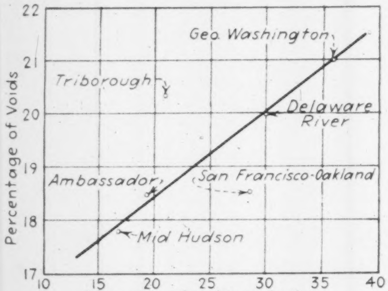


FIG. 8—VOIDS in compacted cables of various suspension bridges.

The number of bolts in each cable band was determined by the slope of the cable and the maximum possible load on the suspenders. The component of this suspender load in a direction parallel to the cable is the force that must be resisted. The factors tending to prevent sliding are: (1) friction, (2) constriction of the cable section beneath the bolted-up band, and (3) angularity in the cable profile at the bands caused by suspender load concentration. For design purposes, it was assumed that the casting is a rigid shell and that one-tenth of the clamping force exerted by the two halves is available to hold it in place.

The exact diameter of the interior surface of the bands was determined by the model cable test already mentioned. In manufacture a gap of $\frac{5}{8}$ in. was left between each half so that there would be no possibility of the bands closing without exerting their full pressure on the cable. However, after the band has been tightened up on the completed cable, this gap is about $\frac{1}{4}$ in. The reduction of this figure below the theoretical amount probably was caused by additional compaction of the cable under the band. The gaps are caulked with oakum, saturated with red lead, and then covered with lead wool thoroughly driven home. The interiors of the bands have a rough finish made by 16 cuts per inch measured along the length of the band. The grooves on the exterior, into which the suspender ropes fit, are ground with an emery wheel.

There are a total of 612 cable bands on the entire bridge. They were delivered to the base of the towers by barge, and lifted with a guy derrick to the top whence high lines carried them to their positions on the cable.

Suspender ropes

At each panel point there are four $2\frac{1}{4}$-in. suspenders, made up of the two single ropes looped over the cable bands. These suspenders were designed to carry one panel of dead load plus the maximum live-load reactions on the upper and lower-deck floorbeams. A factor of safety of three was employed, and it was assumed that the rope would be only 89 per cent efficient when bent around the cable band. On this basis the specifications required the contractor to furnish a rope with a direct tension strength of not less than 410,000 lb. and not less than 380,000 lb. when passed around a sheave 30 in. in diameter.

Specifications required that the modulus of elasticity of the ropes be raised by pre-stressing to not less than 18,000,-

FIG. 9—SPECIAL SPLAY CASTING at center anchorage. Friction collar at left prevents casting from sliding along cable.

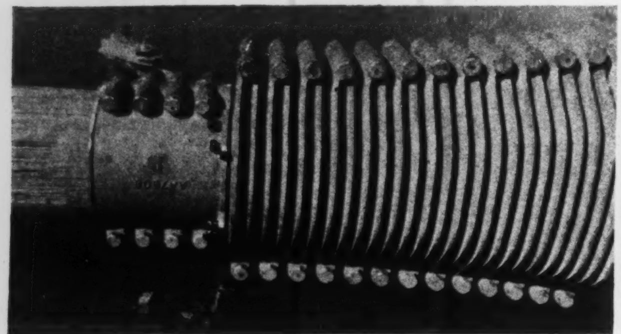
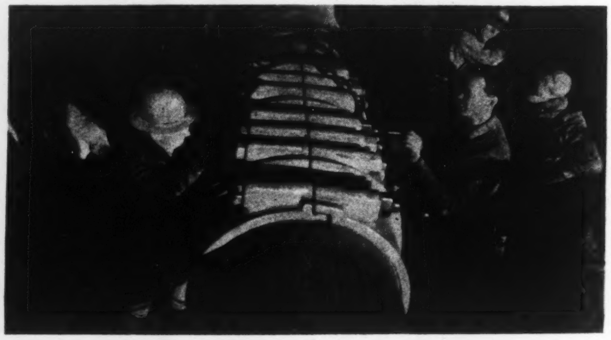


FIG. 10—STRAIN GAGE in use, determining stress in cable band bolts. The minimum load permitted was 68,000 lb. per bolt.



000 lb. per sq.in. To accomplish this the contractor attached one end of a rope about 1,000 ft. long to a 300-ton, horizontal, hydraulic, testing machine. The rope was supported by rollers at 20-ft. intervals, carried around a sheave of 12-ft. diameter and thence back to a concrete anchor block adjacent to the testing machine. A load of 135 tons was put on and maintained for 8 hr. Due to pump leakage and progressive rope elongation, it was necessary to check the load hourly. Of 130 ropes which were thus stressed, the average modulus, as measured on an 850-ft. gauge length, was 21,500,000 lb. This is somewhat higher than found on shorter specimens tested in the laboratory.

After stressing, the ropes were loaded to 63,000 lb. and measured for cutting into suspender lengths. This work was performed at night or when the rays of the sun could not affect the accuracy. Cutting was done with an acetylene torch.

The sockets secured to the ends of the ropes are 60-lb., normalized steel forgings. The end of each rope was splayed and cleaned by successively dipping in a hot oakite solution, a solution of muriatic acid, and finally back into the oakite solution. It was then blown clean with a steam jet and socketed with pure zinc.

Wrapping and painting

The cables are machine-wrapped throughout their length except in certain inaccessible points where hand wrapping is permitted. This wrapping is No. 9, soft-annealed, double-galvanized steel wire, and is applied under a tension of about 300 lb. This work is done with a Robinson wrapping machine, driven by a 10-hp. induction motor. Three wires are wrapped on simultaneously, supplied from spools set at one-third points around the circumference of the wrapping machine. The spools have sufficient capacity to wrap the cable for a full 30-ft. panel without stopping. Wrapping always progresses uphill so that the machine may bear against the wire in place and thus keep it tight. In the reeling plant the splices in the wrapping wire are electric-welded; in the field they are brazed.

Immediately before placing cable bands or wrapping, the portion of the cable to be covered is cleaned with mineral spirits and cable paste is applied. This paste is made up of 0.7 of a gallon of raw linseed oil to 100 lb. of red lead paste. Later, the wrapped surface of the cables, the suspenders and hand ropes are cleaned with mineral spirits, and primer, second, third and fourth coats of paint are applied as on the other steel of the bridge.

Personnel

The cables are part of the superstructure contract for the West Bay Crossing, which is held by the Columbia Steel Co. The personnel of this company was published in *Engineering News-Record*, June 20, 1935, p. 867. The design of the erection equipment including the cable squeezer was made by the engineers of the erection department of the American Bridge Co. Personnel of the California Toll Bridge Authority was published in *Engineering News-Record*, March 22, 1934, p. 377.

Novel High Pressure Grouting Methods Seal Fissures in Wet Tunnel

Full-face timber bulkheads and grouting successive zones at increasing pressures feature sealing of badly broken formation in San Jacinto tunnel on Colorado River aqueduct

By C. R. Rankin

General Superintendent, San Jacinto Tunnel, Metropolitan Water District of Southern California.

ADVANCING the east Potrero heading in San Jacinto tunnel of the Colorado River aqueduct, now under construction by the Metropolitan Water District of Southern California, has necessitated use of several different methods, as new and difficult problems successively have arisen. Water inflows in large quantity have been encountered suddenly not only in the face as driving has progressed but also from the sides. In some instances large inflows have broken in considerable distances back of the face. The very large pump capacity in an installation which the district made to lift water out of this tunnel against a head of 800 ft. was described in *Engineering News-Record*, Aug. 22, 1935, p. 252. Under the protection which that pumping plant afforded the construction force has been able to concentrate on driving operations and on March 26 the east Potrero heading had been advanced 2,119 ft. since the district took over operation. (*Engineering News-Record*, Feb. 21, 1935, p. 298)

A primary problem has been the effective sealing of fissures through which the heavy inflow of water has occurred. In the main this has been done with cement grout applied under high pressure, in some cases with the aid of sawdust at the outset, working in successive zones with increasing pressures. In a few extreme cases timber bulkheads have been necessary to resist the enormous total pressure developed by full-face grouting. Three quite different methods of grouting have been used and conditions encountered have determined which of three to apply in any particular instance.

When the district took over the previously contracted work in the San Jacinto tunnel consultants agreed that the best plan would be to abandon the heading that had been driven 160 ft. east from the bottom of the shaft and, instead, make an offset in the tunnel center line by turning southward for 154 ft. and then turning northward 282 ft. to intersect the original center line. Actually a short detour. This plan, it was hoped, would make it possible to avoid the shattered zone above which overlying strata had been distributed by previous driving operations.

Rock in this portion of the tunnel is granite with schist inclusions. The schist is badly crushed and carries much clay gouge. A notable feature of this granite formation is that for a half mile of tunnel length cracks and fissures have been opened in it. Many of these cracks are filled with gouge which prevents grouting but as inflow occurs the gouge is washed out and the cracks are left empty. Through these fissures overlying water comes into the tunnel rapidly when wet zones are encountered.

After several months of experience with very badly broken and very wet formation a more or less standardized procedure has been developed. In general three methods of attack are used: (1) Advance grouting, (2) shotcrete rings and (3) groutings at successively increasing pressures behind a full-face bulkhead.

Advance grouting

Advance grouting, the simplest method, always is tried first and the other expedients are used only if advance grouting cannot be made effective. Test holes 20 to 35 ft. deep are driven ahead in the face. These holes, starting at 3½ in. in diameter and reducing to about 1¼ in. at the full depth, always are driven in about 35 ft. regardless of the depth at which water is encountered. The pipe that is put into these test holes, however, is not inserted beyond the first material quantity of water inflow. The pipes used are 1½ to 2 in. in diameter and after such a pipe has been inserted to the zone of inflow it is packed outside with lead wool and firmly fastened in place by clamps on the pipe leading to anchor bolts in the rock.

The projecting end of each pipe is threaded and equipped with a valve. After all the grout holes have been so equipped, grout is forced in through the pipes. The grout is mixed in a specially built mixer to the consistency of cream; that is, two to three sacks of cement are used with 25 gal. of water. The pressure pumps employed are capable of delivering up to 1,500 lb. per sq. in., and frequently this pressure is used. All test holes that yield more than 25 gal. of water per minute are grouted. In some cases 2-in. holes have spouted 500 g.p.m. into the tunnel. Water pressures as high as 560 lb. per sq. in. have been encountered.

When advance grouting is under way the grout is pumped in slowly at first at low pressure and if it leaks out through fissures in the face, sawdust is added. In some of the larger fissures the first application has been merely sawdust and water put in in the endeavor to aid somewhat in filling and choking the fissures before grout is forced in. To prevent choking the pressure pumps, sawdust is passed through a screen of ¼-in. mesh. A quick hardening cement is used and ordinarily an admixture of 3 per cent calcium chloride is added to speed up the setting still further. For the most part the test holes fan out around the perimeter of the tunnel although one or two usually are driven parallel to the center line. As many as three separate fissures have been grouted in the face at one time. Where conditions are not bad two to four test holes are sufficient although in some cases as many as six have been used. In a grouting operation in which the entire face has to be treated, as much as 4,600 bags of cement have been pumped in in one setting of the grout pumps.

Rings of air-applied concrete

When grouting through advance drill holes by the method just described does not successfully stop the inflow another expedient is tried. This is to disregard the inflow temporarily and drive on through the water bearing zone, sometimes enlarging the tunnel section slightly so that a ring of air-applied concrete may be shot into place in the fissured zone after heading operations have gone on beyond. The procedure under this method is to place a supporting cage built of reinforcing bars in the zone to be so treated, wire them together and brace them with timbers to hold them firmly in place and then apply shotcrete with two nozzles working simultaneously. This cage is both guide and support for the plastic shotcrete in the crown of the arch. The two shotcrete operators begin at the center of the invert and work away from one another as the layer of concrete is applied up each side. This calls for skillful operators. Usually the operators have to be trained specially, since, to obtain the desired strength in the shotcrete layer, there must be careful control of the rebound and effective placement under difficult working conditions. The shotcrete rings have been put in successfully in zones where the inflow was as much as several thousand gallons per minute. The inflowing water, of course, has to be conveyed temporarily in pipes, troughs or by other means so that the flow does not wash out the shotcrete before it has had opportunity to harden.

Grouting behind bulkheads

The third, or bulkhead method, is the last resort because it is so expensive and delays the work so much that it is justified only in extreme cases where large inflows break in suddenly after shooting and without advance warning in the form of indications from the feeler holes. Up to the first of April this method of using bulkheads had been used eight times.

A typical bulkheading operation on a 20x20-ft. face was carried out in the following manner: The water inflow was first conveyed in five 6-in. drain pipes with control valves at the outer ends. These pipes were carried through a sand bag bulkhead built up close to the face after all voids caused by caving ground and small openings along the rock walls and in the top had been filled with sand and cement or with bags of these materials. Cement sacks filled with sand were then carefully placed to the full height of the tunnel to make a watertight bulkhead 8 ft. thick, cement grout being poured or sprayed over the bags as the wall is laid up. At this time no pressure was exerted against the bulkhead because the inflowing water was passing out through the drain pipes. It was calculated that when the drains were closed the water pressure would build up to about 150 lb. per sq. in. A timber bulkhead to support the sand bag dam was planned accordingly. Braces of 12x12-in. timbers were carried back on either side to the rock walls and were there set firmly against rock abutments that would carry the pressure load. The first grouting was started with the lower drains closed off and water pressure relieved through the upper lines. The first grout consisted of four parts of quick hardening cement and one part of sawdust with 8 gal. of water per sack of cement. After allowing 8 hours for the grout to set all the drain pipes were shut off whereupon the pressure promptly rose to 140 lb. per sq. in. and considerable leakage occurred through and under the bulkhead.

Grouting with sawdust and water and also with a mixture of cement and sawdust cut this leakage down to a small flow. Grouting through holes in the rock which had been drilled around the perimeter to a depth of about 25 ft. into the broken zone was then carried on and was found to require about 250 lb. per sq. in. to get penetration. A total of 1,188 sacks of quick hardening cement was placed in this grouting operation in which about 7 gal. of water was used per sack of cement.

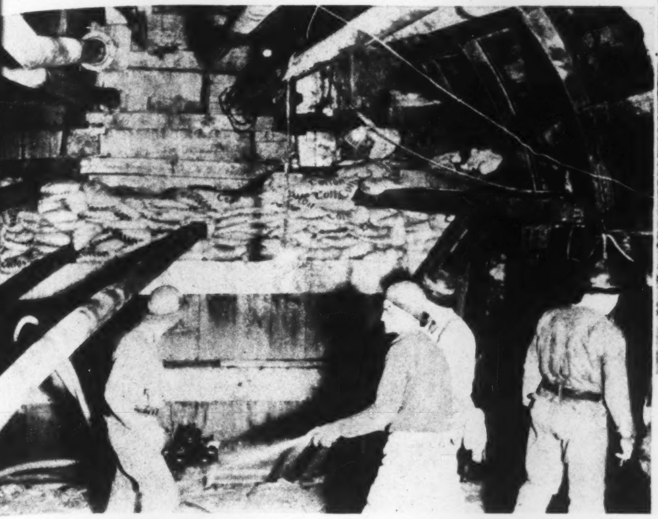
After a setting period of 24 hours the bulkheads and sand bag dam were removed and it was found that broken up rock had been solidified with grout to such an extent that the inflowing water had been stopped almost entirely. As the heading was advanced it soon appeared that the considerable amount of clay in the broken zone filled the fissures which had not been sluiced out by inflowing water so that grout had not penetrated much beyond the bottom of the grout holes. However, for the time being, additional drill holes and the ordinary advance grouting process took care of the inflow beyond the grouted zone.

Design pressure of 250 lb.

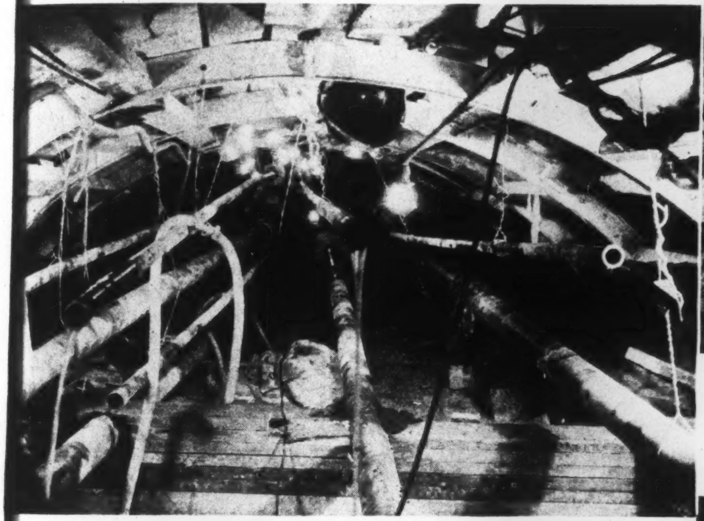
On another occasion the full-face bulkhead was used after a single drill hole into broken material was widened out by inflowing water to a diameter that permitted a flow, under the existing pressure head, of 3,000 g.p.m. In this case it was decided to design the bulkhead for the 20x20-ft. heading to withstand a pressure of 250 lb. per sq. in. or a total of 11,000,000 lb. for the entire heading. The sand bag dam was here made to fill the tunnel for a distance of 22 ft. and was backed up by a facing of 12x12-in. timbers with 30 braces of the same size to the side walls. The same successive grouting scheme was used and when closing off the drain pipes the pressure went up to 170 lb. per sq. in. These pressures were read on 2-in. grouting pipes which were placed through the bulkhead and to a point well up in the water bearing fissures so as to get beyond zones where grout would likely interfere with a true gage reading. This bulkheading operation likewise was successful although again in this instance the grouting was found to have extended only a short distance beyond the bottom of the grout holes, emphasizing the fact that effective grouting can be carried on in this formation only after the gouge in the fissures has been sluiced out by moving water.

The San Jacinto tunnel is being driven under direction of the engineering staff of the Metropolitan Water District of Southern California; Frank E. Weymouth, general manager and chief engineer. J. L. Burkholder is assistant general manager and J. B. Bond is division engineer of divisions 5 and 6. The author is general superintendent on the San Jacinto tunnel.

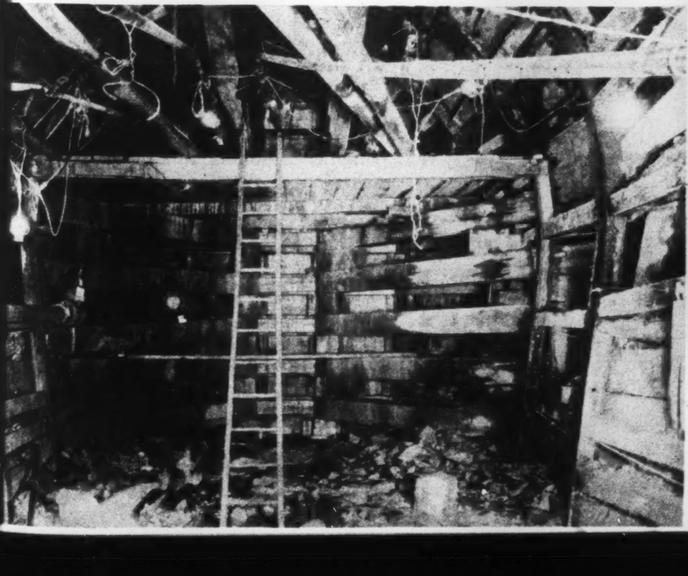
G. 1—TYPICAL TIMBER BULKHEADS with filling of sand bags between. ment grout is being sprayed over the sacks in the section being built up in the foreground. Bleeder pipes through the bulkhead are carrying 10,000 g.p.m.



IG. 2—ARCH SECTION of a sack bulkhead. As much as a 22-ft. length of tunnel etween timber bulkheads was filled with sacks in such operations. Open pipes are r grout on which pressures up to 1,500 lb. per sq.in. sometimes are used. The bulkhead facing is of 3x12 timbers laid flat.



IG. 3—COMPLETED BULKHEAD with 12x12-in. braces to notches in tunnel walls. Under pressures of 250 lb. per sq.in. these bulkheads were figured to carry a 5,500-ton total load.



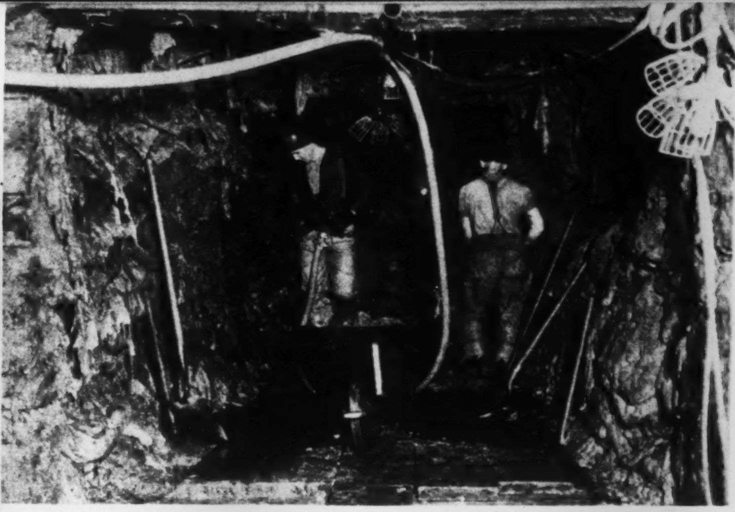


FIG. 4—A PILOT HEADING is cut through the arch section of the grouting bulkhead after grouting has been completed, the cut being made through the plank facing of the bulkhead and then through the sand bags laid in grout. Air-driven spades are used for excavating.

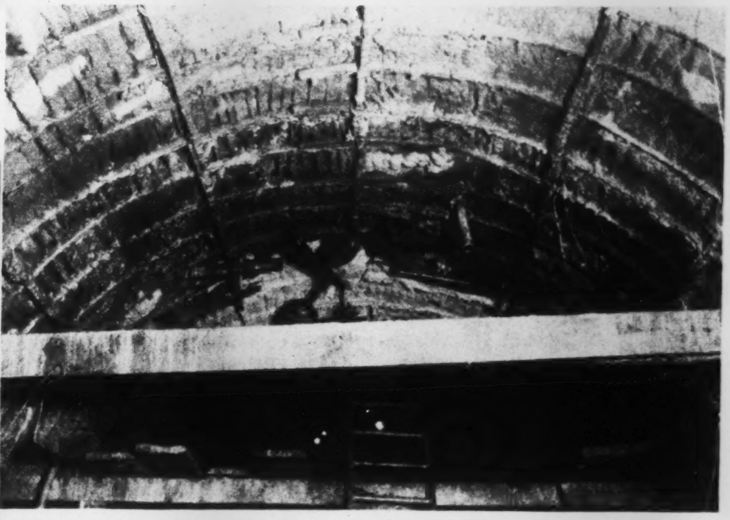


FIG. 5—AN ARCH RING OF SHOTCRETE. Steel bars are used as guides and as template to hold the plastic material in place. Grout pipes extend through the reinforcing ring.

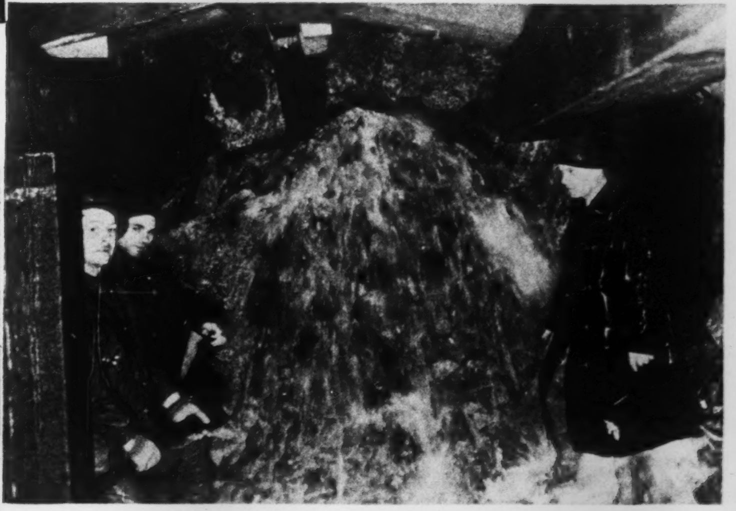


FIG. 6—TYPICAL WATER INFLOW into San Jacinto tunnel after a shot at the heading. The water is cascading over the muck loosened by the shot. It is inflows such as this that require the use of the bulkheads as an aid to grouting.

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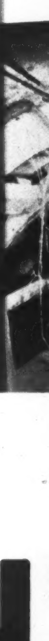

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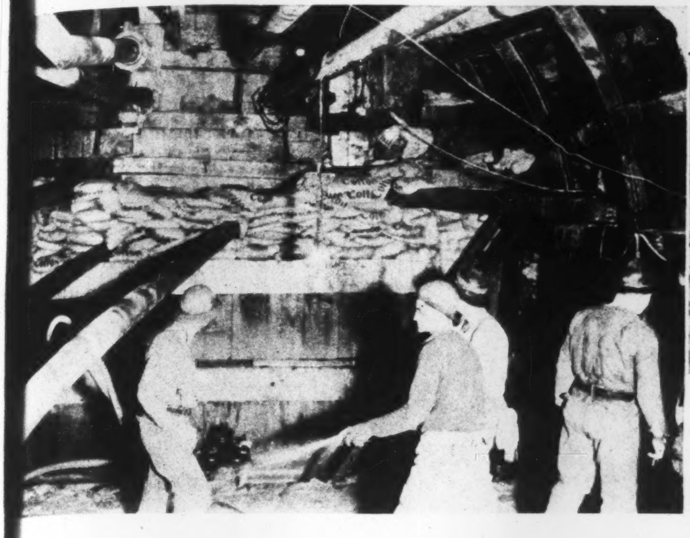

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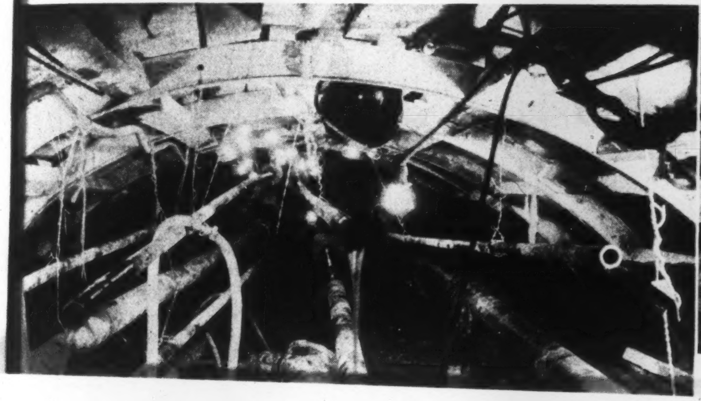

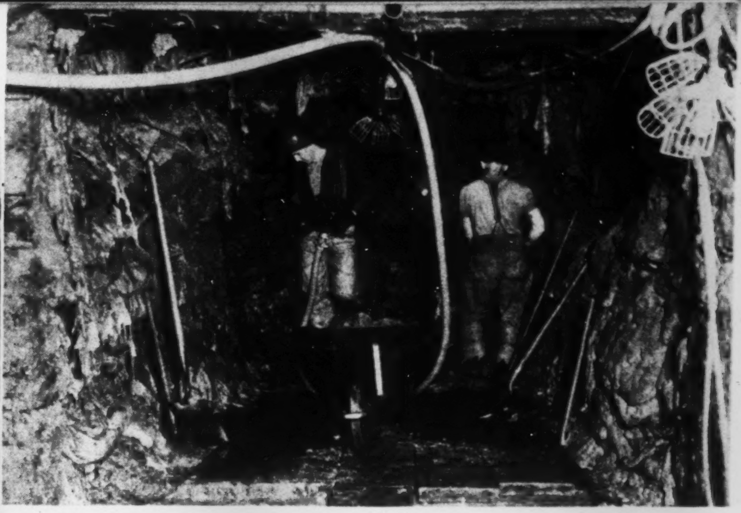

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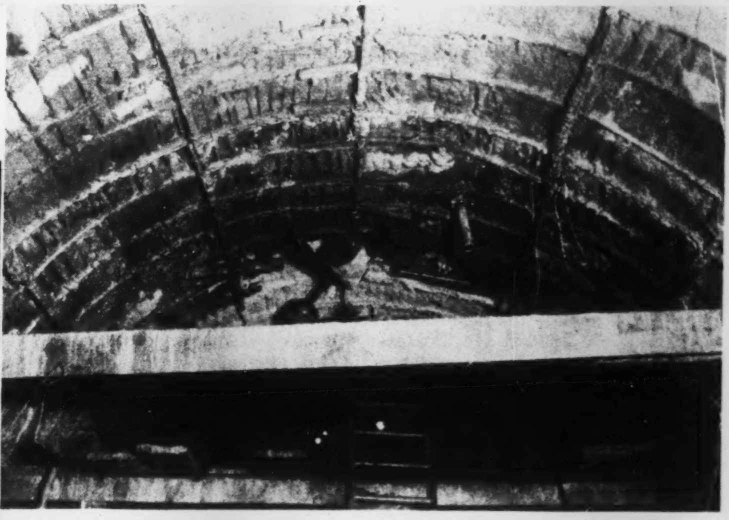

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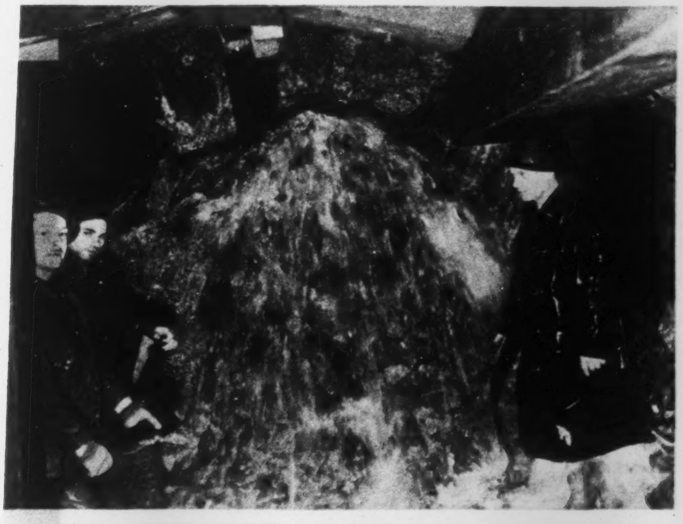

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WATERING THE GREAT PLAINS

Effective conservation of groundwater, the Plains' most vital reserve against recurring periods of drought, awaits intensive engineering study and a more satisfactory group of water-right laws

BECAUSE OF THE CYCLIC SWINGS of rainfall that bring alternating prosperity and ruin to the Great Plains—that vast, semi-arid farming belt where formerly the cowboy reigned—pumping from wells has been widely adopted to provide more regular water supply to the farm. Larger use of wells is possible, the author said recently in a paper before the Institute of Irrigation Agriculture, if the flow of water through soil is more thoroughly studied and the engineering problems of well construction and efficient pumping-plant design are worked out. The highest use of the groundwater, however, is not for regular farm supply but for reserve storage against severe drought. To conserve the water for this use an adequate code of water-right laws applicable to groundwater is necessary. The present article emphasizes this essential need. —EDITOR.

By George S. Knapp
Chief Engineer, State Division of Water Resources, Topeka, Kansas

THE GREAT PLAINS comprises an area of about 400,000 sq.mi. extending over ten states from the 98th meridian westward to the 5,000-ft. contour along the foothills of the Rocky Mountains, and from the Canadian boundary southward to the 32nd degree of latitude. Geologically it is the remnant of an old débris apron built largely by mountain waste, stream-spread to great distances over an impervious floor of rocks of an earlier age. It constitutes an uneven network of gravel courses and elongated beds of sand penetrating a mass of silt and sand-streaked clay.

This porous material, two or three hundred feet thick, is filled to great depths with water; water can be found at depths of a few feet in some localities, while south of the Canadian River, near the eastern edge of the High Plains, its surface is nearly 400 ft. below ground. But in some localities little or no water can be obtained, because broad swells of the underlying rock rise above the watertable. Rivers which cross the Great Plains belt, such as the Platte and the Arkansas, have carved out wide and deep valleys, which in time became backfilled with deep alluvial deposits, principally sand and gravel washed down from the mountains. This river fill is another important source of groundwater supply.

The climate of the Great Plains is variable. One season may have almost humid, another almost arid conditions. The average rainfall varies from about 12 in. per year along the western edge to 20 in. at some points in the eastern part. Because of high wind velocities and summer temperatures, evaporation is about three times the rainfall. Soil moisture rather than soil fertility is the limiting factor in crop production.

Underground water abundant

Next to the soil, therefore, the groundwater underneath is the most valuable of the natural resources of the Plains region. It provides abundant water for human consumption and for the use of railroads and industries, and has some surplus available for irrigation by pumping from wells. Unlike the rainfall and the surface waters, this underground supply does not vary greatly between wet and dry years. During the recent severe drought in the Mississippi basin there was no actual shortage of groundwater in the Great Plains portion of the basin. To the east of this region the farmers and many cities faced acute water famine, but in the Plains area no farm home or ranch was short of well water, and cities that obtained their supply from wells did not have to restrict use but in many instances offered special inducements to the residents to use water generously in order to save trees, lawns and gardens.

Irrigation by pumping from wells is practiced to some extent in the Plains portion of each of the ten states. The United States Census of 1929 showed 2,044 such pumping plants in this area (513 in Nebraska, 504 in New Mexico, 407 in Colorado, 281 in Kansas, 166 in Texas, and 141 in Montana, and 32 scattered through North Dakota, South Dakota, Oklahoma and Wyoming. Their total reported capacity was 2,266,000 gal. per min. or about 5,000 cu.ft. per sec. Many more were built during the succeeding drought period.

Some of these pumping plants are used only to pump water into irrigation canals during periods of the year or during years when the surface supplies for the canals are inadequate. Others are used for the irrigation of individual tracts of land under ditch systems where the water rights are such that the supply is generally insufficient for the needs of the land. In other localities pumping plants constitute the only source of irrigation supply, and make it possible to grow high-value crops such as sugar beets, potatoes and melons, whereas the adjacent unirrigated land is planted to wheat and the sorghum crops. In other instances pumping is used to bring about more regular and satisfactory yields of the crops which are commonly grown there. The most notable instance of that kind is corn and alfalfa irrigation in the Platte valley in central Nebraska, at the extreme eastern edge of this region.

Well and pump problems

Nearly all of the pumping plants are located in the river valleys rather than on the upland—in Colorado, Nebraska and Kansas practically all of them in the Platte and Arkansas River valleys. Only in Scott County, Kansas, and in the western part of the Texas Panhandle and an immediately adjacent part of New Mexico is much pump irrigation development found on the high plains. Extensive areas are found throughout the Great Plains belt where sufficient water supplies exist at depths of from 50 to 150 ft., but at prevailing costs and crop prices it is evident that special conditions of climate, crops and markets must prevail to justify irrigation pumping from wells on the upland. Authorities hold that in both Colorado and Kansas the economic limit of lift under present conditions is about 30 ft. for general farm crops.

Many problems remain, in connection with pump-irrigation agriculture. The most apparent, although possibly not the greatest or most difficult of solution, are those connected with the design, construction and operation of the pumping plant.

In one and the same geological formation, irrigation wells anywhere from 10 in. to 10 ft. in diameter may be found. Some of the well strainers used have openings so small that after a short period of use they practically exclude the water from entering the well; others have openings so large that they admit sufficient sand to cause injurious caving around the well. Well construction differs so much that in substantially the same material one plant obtains a yield of 40 g.p.m. per square foot of strainer while another obtains but 15 g.p.m. There is need of further study of the movement of groundwater through the sands and the flow of water into wells, and also need of engineering judgment in the construction of the wells.

A like remark applies to pumping plants. One plant may be so constructed that it has a drawdown of 10 ft.; another, with the same initial depth to the watertable, has a drawdown of 50 ft. (and therefore 40 ft. more total lift than the first). Again, the mechanical efficiency of one plant may be less than 30 per cent, that of another more than 60. The cost of pumping may be but $1 per acre-foot with one plant, and $22 with another, under the same conditions of water supply. There is hardly a state in the Great Plains that has not issued one or more publications on well construction, pump selection and cost of pumping; yet the conditions just cited are common today.

The supply must be conserved

Most important of all, however, are the problems that involve the water supply itself. Our groundwaters are no longer thought to be inexhaustible. In many places they have been diminishing with use. As costs of pumping become less or markets for crops improve, pumping from wells for irrigation is certain to increase, and it may be taken as certain that ultimately the entire available supply will be utilized. Can we as states so direct and control this development that the greatest amount of permanent wealth will be created and maintained by its use, and at the same time prevent eventual overdevelopment and exhaustion of the water supply and the destruction of the values created? Can conservation measures be taken which will increase or augment existing supplies as they approach complete utilization? These are problems of prime importance.

In probably few, if any, parts of the Great Plains area have groundwater supplies been seriously depleted to date. While little information on watertable fluctuations due to pumping has been available until recent years, we now have a number of measurements that show how much the watertable is lowered during the pumping season and how fast it rises after pumping ceases.

In the Platte valley in Nebraska, between Grand Island and Cozad, the U. S. Geological Survey in cooperation with the state has been measuring the water levels in 100 wells periodically since October, 1930. These wells are in Nebraska's principal pump irrigation district. In October, 1934, the water level stood from 1 to 8 ft. lower than four years before, a lowering occurring each year during the pumping season, April to October, and some recovery occurring during October to April, but with a general downward trend during the four years—a period of subnormal precipitation and relatively small river flow.

In the Arkansas valley in Kansas, in Finney and Kearny counties, where about 20,000 acres are irrigated by pumping from wells, the seasonal lowering of the watertable each year is 1 to 6 ft. Recovery usually sets in soon after the end of the pumping season, or sooner if there are flood flows in the river, and it is seldom that complete recovery has not taken place before the beginning of the next pumping season. In this region the full normal streamflow is diverted for direct irrigation; but late-summer flash floods and winter flow, which cannot be so diverted and therefore are not directly usable, make an important contribution to the groundwater supply. Measurements indicate that an annual average of more than 20,000 acre-feet is absorbed in this recharging process between Syracuse and Garden City, which fact no doubt explains why there has been no permanent lowering of the watertable in this valley during twenty or more years of pumping.

In the Scott County pumping district, records of water levels are available only since 1931. As in the preceding instances, the watertable has shown seasonal fluctuations, falling during the pumping season and tending to recover during the period of non-use, but the irrigated acreage has steadily increased since 1932, and since 1933 the water levels have shown a slight downward trend. In 1935, when 4,000 acres were irrigated, levels were 1 ft. lower for corresponding seasons of the year than in 1933, when only 2,000 acres were irrigated. Whether this small downward trend is due to the prolonged drought of 1930-34 or whether the irrigation of 4,000 acres will bring about a gradual lowering of the watertable cannot yet be judged.

Research and water laws essential

The problems of the best utilization of our groundwater supplies for irrigation are much more complex than those met in the use of surface supplies. Their solution involves, first, extensive research, investigation and study to determine the extent and availability of these supplies, and the relation between their use and depletion; second, the formulation of broad policies for their most beneficial use, and third, the enactment of suitable laws to make these policies effective.

It is hardly probable that uniform groundwater laws throughout the Plains states will be necessary or would best meet the ends to be attained. Obviously, if the most valuable use to which the water can be put in one locality is to supplement a surface supply made deficient by drought, that end would be defeated by laws which place pumping plants for such purposes on the same basis of priority of right according to date of construction as ditches using surface supplies.

Water cannot be stored in surface reservoirs in the Great Plains belt and held for long periods of time against a probable drought year, or it would all be lost by evaporation within a comparatively few years. On the other hand underground storage can, in many places, be held for long periods of time with little or no loss. If these underground reservoirs are to be used to reduce the disastrous effects of drought periods, we should prevent such unrestricted use and expansion as will develop their full capacity for the current needs of normal seasons.

These and many other questions of use should receive the thoughtful consideration of each state in the Great Plains area. Some have already started, and report progress. For the others, it is, in most instances, not too late to begin—nor is it too early.

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Proposed Simplified Practice for Coarse Aggregates

A proposed simplified practice recommendation for sizes of coarse aggregates, crushed stone, gravel and slag has been sent for approval to producers, distributors, users and others interested by the Division of Simplified Practice of the National Bureau of Standards. The recommendation consists of two tables designated as Group A and Group B sizes of coarse aggregates. Each table gives size number, nominal size of square openings of sieves, approximate size of round openings, and the amounts finer than each sieve (square openings), percents by weight for primary, and combined and modified sizes. Two tables showing typical uses for Group A and Group B sizes are included.

The recommendation was submitted by the joint technical committee of the Mineral Aggregates Associations, which includes representatives from the National Crushed Stone Association, the National Sand and Gravel Association, and the National Slag Association. Copies of the proposed recommendation may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

Practical Soil Mechanics at Muskingum—IV

By Theodore T. Knappen and Robert R. Philippe
Chief, Engineering Division, and Director, Soils Mechanics Laboratory, U. S. Engineer Office, Zanesville, Ohio

Selection and Control of Embankment Materials

THE PREVIOUS ARTICLES in this series (*ENR*, March 26, p. 453; April 9, p. 532; April 23, p. 595) have discussed: (*1*) the methods of investigation and classification, in producing a picture of the problem involved in the design of the Muskingum dams; (*2*) the methods used to study the permeability and seepage characteristics of the proposed structure on its foundations; and (*3*) the methods used to analyze the structural characteristics of the foundation from the viewpoints of consolidation, strength and stress intensity and distribution. This final article in the series will discuss the selection and control of embankment materials and will present an analysis of the cost of the laboratory work.

One of the most important items in the design of earth dams is the selection and use of embankment materials. Economy dictates that all materials from required excavations should be used in the embankment, that no materials from excavations should be wasted unnecessarily, and only such materials should be obtained from borrowpits as are necessary to complete the construction. Where excavation materials can all be used in the construction of the embankment, it is frequently possible to use very large spillway excavations with great economy. The seepage model test previously described was extensively used in working out practicable designs which would utilize for various purposes materials that were available at the different sites.

Generally speaking, almost any material can be used somewhere in the embankment if it can be properly placed, providing that it will not dissolve in water. It is important to know, however, the characteristics of the various materials. For example, when rolling with sheepsfoot rollers, we must determine at what moisture content optimum consolidation will occur. Obviously, a deficiency in moisture content can be met by the addition of water before placing or spreading. However, if the material has an excess of water, it must either be wasted or dried out before it can be used in the embankment. This last requirement frequently determines the depth to which excavations may be made in borrowpits and the depths of required excavations that can be utilized. Where large amounts of necessary excavations must be wasted, a change in the design may result in saving.

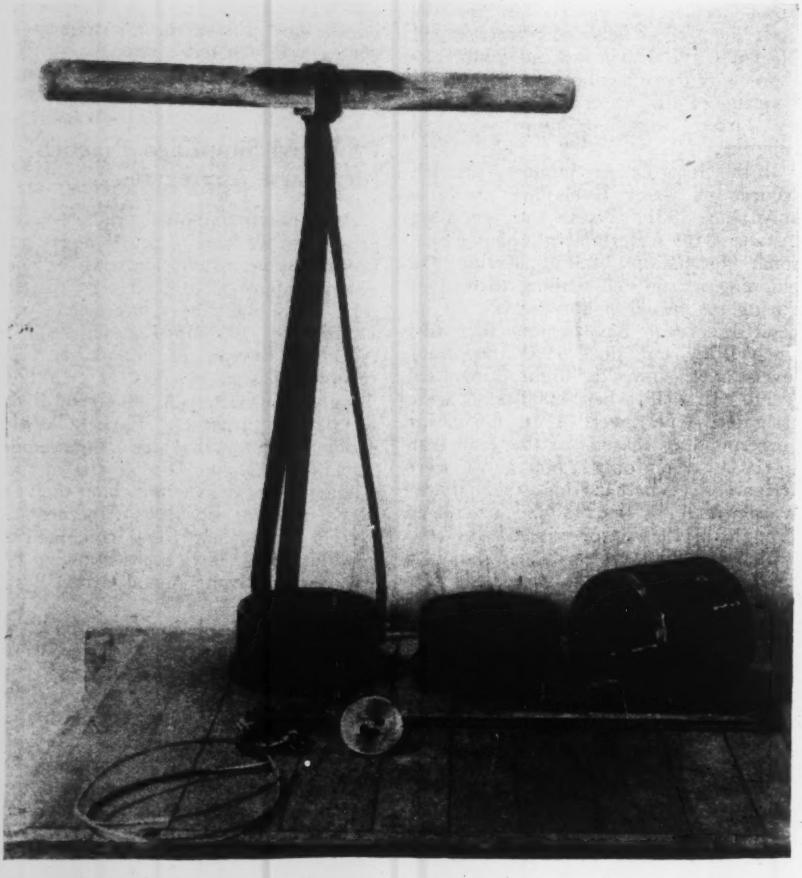

FIG. 19—UNDISTURBED EMBANKMENT SAMPLES, from which degree of consolidation and the weight of embankment are determined, are secured by the simple hand tools illustrated here.

FIG. 20—DEVICE simulating action of sheepsfoot roller, used to prepare samples to determine moisture content for optimum consolidation.

Embankment consolidation

In the last few years methods of embankment consolidation have received

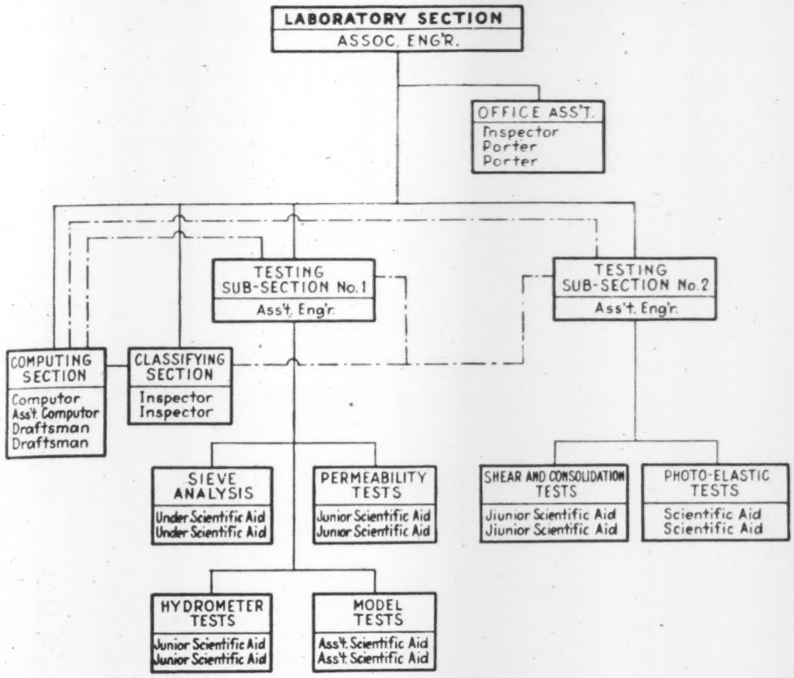
LABORATORY SECTION
ASSOC. ENG'R.
OFFICE ASS'T.
Inspector
Porter
Porter
TESTING SUB-SECTION No. 1
Ass't. Eng'r.
TESTING SUB-SECTION No. 2
Ass't. Eng'r.
COMPUTING SECTION
Computor
Ass't. Computor
Draftsman
Draftsman
CLASSIFYING SECTION
Inspector
Inspector
SIEVE ANALYSIS
Under Scientific Aid
Under Scientific Aid
PERMEABILITY TESTS
Junior Scientific Aid
Junior Scientific Aid
SHEAR AND CONSOLIDATION TESTS
Jiunior Scientific Aid
Jiunior Scientific Aid
PHOTO-ELASTIC TESTS
Scientific Aid
Scientific Aid
HYDROMETER TESTS
Junior Scientific Aid
Junior Scientific Aid
MODEL TESTS
Ass't. Scientific Aid
Ass't. Scientific Aid

FIG. 21—A SIMPLE WORKING ORGANIZATION is sufficient to handle many varieties of tests at the Muskingum laboratory.

critical attention from the engineering profession. It has been generally recognized that the proper consolidation of embankments during construction is highly desirable. Proctor, in a series of articles in *Engineering News-Record*, established certain rules and methods for obtaining embankments of highest possible density. His methods establish what relations exist between the moisture content, the weight of sheepsfoot rollers and the number of trips of the rollers, which determines the degree of consolidation to be obtained for any particular material.

As a general rule, we have aimed to place materials in the embankment to such a degree of consolidation that the embankment will take no shrinkage after construction. This degree of consolidation can be determined by molding a sample of borrowpit material and then consolidating it in the consolidation device under various increments of load. The dry weight of the material per cubic foot may then be determined for any height of superimposed embankment. By correcting for the water content, the minimum permissible embankment weight may be determined. This weight is furnished to the inspectors in the field to check the embankment weights by taking undisturbed cylinder samples in the field with equipment illustrated in Fig. 19. Generally speaking, very little difficulty is met in getting the weights in excess of the minimum required.

The sampling device consists of a piece of stiff seamless tubing with one end beveled, exactly 1/10 cu.ft. in volume. A steelyard is used to weigh the sample in the field. The samples are obtained by forcing the beveled edge of the cylinder down into the ground and digging away around it as the cylinder is lowered. As a check against this method and for cases where too many pebbles, gravel or rock fragments are present, the sample is taken by levelling off a space on the embankment, carefully cutting out a sample, weighing it and measuring the volume by pouring into the excavation dry sand of known weight per unit volume. Generally speaking, the two methods check very closely.

Determining moisture content

To determine the proper moisture content at which optimum consolidation may be obtained, a device was developed in the laboratory for tamping the material so as to simulate the action of the sheepsfoot roller. Fig. 20 shows this machine. The material of uniform and known water content is placed in 3-in. layers, and each layer is tamped three times with a tamper foot. The top collar is then removed from the cylinder, the material shaved off to the exact dimension of the cylinder, and the sample weighed. When the known weight of the cylinder is deducted, knowing the water content, the dry weight may be obtained from the total weight of the sample. This process is run through for a number of water contents, and a curve illustrated in Fig. 22 is prepared, which shows the degree of consolidation obtained by the method of test for each water content. It may be noted that for materials of clay or silt types, the optimum water content is just slightly less than the water content at Atterberg's plastic limit. For the type of equipment used—that is, sheepsfoot rollers—this gives a quick method of checking the condition of the material in the field. Practice has indicated that by varying the limiting dimension of the test for plastic limit suitable control of water content will result.

Where uniform materials of silt and clay type are used, the weight of the material in the embankment usually varies from 118 to 125 lb. per cu.ft. Where well-graded material running from rock fragments or gravels on down through clay size is obtainable, weights varying from 125 to 145 lb. will result, with a few reading as high as 156 lb. per cu.ft. Materials running high in silt sizes and running more than 25 per cent in the clay sizes are difficult to handle and should be avoided. Because of the wide variation of the materials obtained from the excavations and borrowpits in this locality, it was not found practicable to add water in the borrowpits, and further, it is not feasible to add any specified amount of water in the embankment.

Water is added to the surface of the previous layer immediately prior to dumping and spreading. Layers are spread about 6 in. thick before rolling. An inspector supervises the addition of water to bring the material to the water content, which gives the maximum consolidation. After a certain amount of experience, inspectors become adept at determining the amount of moistening needed. They check their results by weighing frequent samples of embankment material. They are guided by the Atterberg plastic limit test and by the way the material acts under the rollers and hauling equipment. It must be added that weathered shales have proved to be very satisfactory impervious embankment materials when so treated.

FIG. 22—PROCTOR CURVE, showing the compaction characteristic of a soil under a given load and a specified treatment.

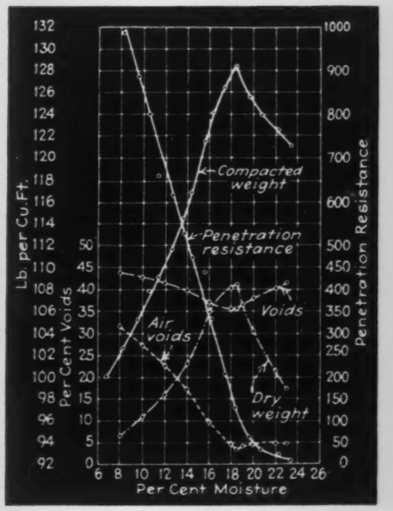

TABLE OF INITIAL COST TO SET UP A SOILS LABORATORY

Equipment	Zanesville Laboratory No.	Zanesville Laboratory Unit Cost	Zanesville Laboratory Total Costs	Laboratory for Single Dam No.	Laboratory for Single Dam Unit Cost	Laboratory for Single Dam Total Costs
Furniture	..	......	$238.96	..	......	$95.00
Scales and weights	2	$66.44	132.88	1	$ 66.44	66.44
Glassware	..	......	166.80	..	......	80.00
Miscellaneous	..	......	26.62	..	......	15.00
Sieve Analysis						
Rotap	2	237.10	474.20	1	237.10	237.10
Sieves (29 sieves, top and pan)	3 sets	83.45	250.35	1 set	83.45	83.45
Furniture: sinks and ovens	..	......	273.47	..	......	130.00
Balances and weights	2 sets	22.24	44.48	1 set	22.24	22.24
Miscellaneous	...	......	46.77	..	......	25.50
Hydrometer Analysis						
Furniture: sinks and ovens	..	......	498.16	..	......	217.35
Glassware hydrometers	..	......	505.24	..	......	155.20
Balances, weights and watches	..	......	225.87	..	......	100.00
Permeability Tests						
Furniture: sinks, etc	..	......	226.06	..	......	200.00
Glass and rubber tubing, etc	..	......	202.53	..	......	100.00
Lumber	..	......	56.84	..	......	20.00
Miscellaneous	..	......	74.25	..	......	30.00
Model Tanks						
Steel tank (40x7x3 ft.)	1	......	1,850.00	..	......	......
Glass tank (14x2 ft.x ½ in.) by contact	..	......	216.19	..	......	216.19
Wooden flume (piping)	..	......	75.00	..	......	......
Consolidation Tests						
Consolidation machines	4	117.14	468.16	2	117.14	234.08
Glassware, tools, etc	..	......	53.02	..	......	26.00
Shear Tests						
Shear machine	1	343.45	343.45	1	343.45	343.45
Glassware, tools, etc	..	......	38.90	..	......	20.00
Polarimeter and Equipment	1	127.50	127.50	..	......	......
Humid Room						
Humidifier	1	26.05	26.05	1	26.05	26.05
Lumber, paint and hardware	1	102.03	102.03	1	102.03	102.03
Electrical work	..	......	228.60	..	......	150.00
Plumbing	..	......	250.00	..	......	150.00
Office furniture	..	......	313.50	..	......	175.00
			$7,595.88			$3,020.08

The optimum moisture content varies for the materials in these embankments under the methods of rolling specified (six trips of a water-ballasted sheepsfoot roller), from 10 per cent for sandy material to 35 per cent for materials running around 25 per cent clay sizes.

The discussion of methods controlling embankment consolidation applies to materials that are relatively impervious such as well-graded materials, or materials high in silt or clay content. For the proper consolidation of sandy and gravelly material used in the shells of the embankment, a liberal use of water and plain rollers will serve. For rock fills the practice is to dump in 5-ft. lifts working over the lifts with the hauling equipment. The use of a good stream of water is helpful in insuring a dense fill.

It should be pointed out that where material is over-consolidated there is a tendency to rebound, which may take the form of lateral expansion. With materials that can be considered to have a large coefficient of expansion when so placed, serious results may ensue. Materials containing a high percentage of clay fall in this class. Unless adequate rock or gravel shells are provided, extreme caution should be exercised in consolidating such materials. These materials are highly impervious even with very light rolling, so there is little need for their thorough consolidation in dams of proper design.

Laboratory plan and costs

The organization of the laboratory is illustrated by the chart, Fig. 21. The investigation, design and construction of the project are under the direction of the U. S. Engineer Department, Major General E. M. Markham, chief of engineers, and Col. Roger Powell, division engineer. The Zanesville Engineer district, which handled the work, is under the direction of Major J. D. Arthur, Jr., district engineer, with one of the authors, Theodore T. Knappen, in charge of the engineering division as senior engineer. The soils mechanics laboratory of the engineering division is under the direction of the other author, Robert R. Philippe, associate engineer. Dr. Glennon Gilboy, association professor of soil mechanics at the Massachusetts Institute of Technology, was consulting engineer on the design and construction of the laboratory and has advised in the development of much of the technique. Associate professor Fred L. Plummer, of the Case School of Applied Science, assisted in the development of the photo-elastic method of foundation analyses.

Fig. 23 is a plan of the laboratory, showing the distribution of the equipment and the floor-space requirements for the different items. The total cost of all equipment in the laboratory, including the cost of erection and construction, was approximately $9,000. The accompanying table lists the major classifications of equipment giving their costs. The total operating and construction cost of the laboratory to the end of the design period was $32,000. It should be noted that this laboratory was designed to handle the design and construction of fourteen reservoirs estimated to cost $40,000,000. Core borings, auger borings and test pits cost $225,000 for the project. The $32,000 plus $12,000 for geological studies represents the cost of reducing the data obtained from these explorations for application to the design of the project. For projects with less volume of work, laboratory installation and operating costs would be much less. The minimum installation cost for a laboratory to handle one or two dams would be about $4,500, details of material costs being given in the accompanying table.

In carrying out the design of the Muskingum project, the laboratory has been considered and used as an integral part of the design organization. It was designed and built to meet the needs of this project, which presented widely varying problems. Even so, certain phases of soil mechanics work had little application in our set-up. The liquid limit and shrinkage limits tests exten-

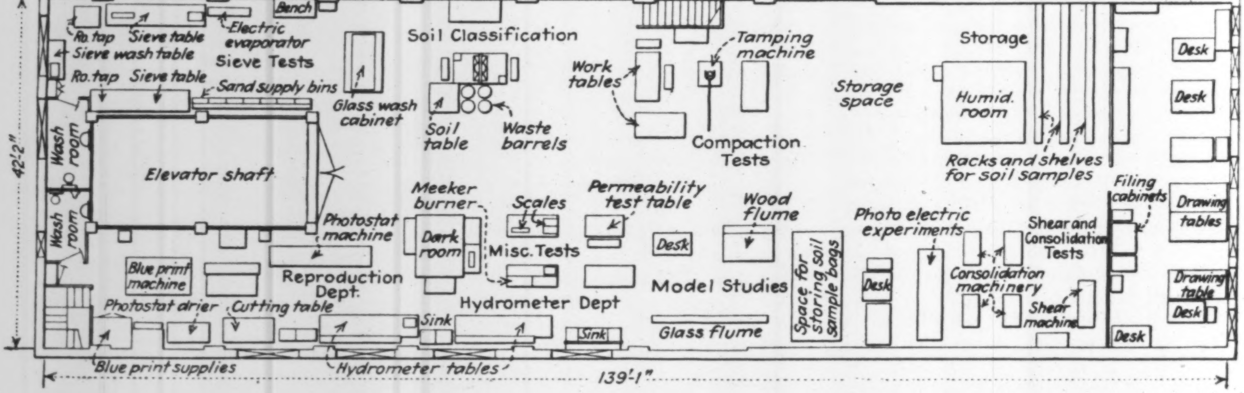
Bench
Ro.tap
Sieve table
Electric evaporator
Sieve wash table
Sieve Tests
Ro.tap
Sieve table
Sand supply bins
Glass wash cabinet
Soil Classification
Soil table
Waste barrels
Work tables
Tamping machine
Compaction Tests
Storage space
Storage
Humid. room
Racks and shelves for soil samples
Desk
Desk
Wash room
Elevator shaft
Wash room
42'-2"
Photostat machine
Meeker burner
Dark room
Scales
Misc. Tests
Permeability test table
Wood flume
Desk
Photo electric experiments
Shear and Consolidation Tests
Filing cabinets
Drawing tables
Blue print machine
Reproduction Dept.
Hydrometer Dept
Model Studies
Space for storing soil sample bags
Desk
Consolidation machinery
Shear machine
Drawing table
Desk
Desk
Photostat drier
Cutting table
Sink
Sink
Glass flume
Blue print supplies
Hydrometer tables
139'-1"

FIG. 23—PLAN of soils laboratory for Muskingum Valley dams.

sively used in highway work did not concern us. As there were no hydraulic-fill dams in this project, no special equipment was developed for their control, although it is felt that most of what is needed is on hand. Our experience has brought home to us the fact that there is an answer that can be worked out in the laboratory to every problem in soil mechanics, and that the laboratory solution of these problems pays many times over in the proper design and construction of earthworks. By the intelligent use of the laboratory, guesswork may be pushed out of its dominating position in earth engineering, and the solution of such problems can be put on the same rational basis as the more advanced branches of engineering design.

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Portsmouth River Wall Again Protects City

Citizens of Ohio River town at mouth of the Scioto find that $650,000 flood control works have paid for themselves many times as high waters sweep harmlessly past the city

By Chas. S. Stevenson and Arthur E. Wall
City Engineer and former Assistant City Engineer, Respectively, Portsmouth, Ohio

WHILE THE HIGH waters of mid-March floods were inundating homes, mills and business blocks of scores of towns and cities in the upper Ohio Valley, citizens of Portsmouth, Ohio, went calmly about their business behind the protection of a river wall and levee system started years ago by a far-sighted city engineer. Once more the Ohio River in flood stage was sweeping harmlessly by as it had done repeatedly in the past leaving the city dry and undisturbed. The citizens' investment of $650,000 of their own money in flood protection has been repaid manyfold.

Portsmouth, having a population of 45,000, lies on the north bank of the Ohio River at the mouth of the Scioto River, which forms the western boundary of the city. The southwestern part of the city, which includes much of the business district, lies at El. 520 ft. to 536 ft., as compared with low water in the Ohio at El. 470.46, which is zero on the local river gage. A navigation dam below the city maintains a 13-ft. pool at normal times.

Protected to a 62-ft. Stage

Following the distastrous flood of 1907, the late J. I. Hudson, then city engineer, developed a plan of flood protection by means of walls and levees and built the first of three wall sections in 1908 despite strenuous opposition from many citizens. He assumed a flood stage of 62 ft. as the economical limit for protection. Records showed that only once from 1832 to 1908 had the flood stage exceeded 62 ft.: that was in 1884. In 1913 the river reached its highest recorded stage, 67.8 ft., paralyzing the city. During the recent flood the highest stage was 59.2 ft.

The protection system, now complete with added sections built in 1916 and 1929, consists of a concrete wall 15,300 ft. long, extending along the Ohio River waterfront and around the point for a short distance up the Scioto, and a short earth levee at the extreme east end of the wall.

Comprehensive dike plan

Dependence for protection on the west (Scioto River waterfront) is placed in the B&O R.R. embankment, which provides an effective barrier across the low spots in this part of town. At the east end of the city the N&W R.R. embankment serves as a protecting levee along the Ohio. The wall ties into both railroad fills.

Four pumping plants have been built to take care of the city's sanitary and storm sewage when the rivers are in flood. When a flood stage of 45 ft. is reached, the outlets of the sewers are closed by gates, and all sewage is pumped. The trunk sewers serve as storage reservoirs for the sewage, and are pumped out intermittently. At the mouth of Lawson Rune, a small creek flowing through the eastern part of the city into the Ohio, a fifth large pumping station has been built. This plant not only serves as a pumping station, but also as a barrier to keep high river waters from backing up the creek and flooding the city. The capacity of all five pumping stations is 94,000 gal. per min.

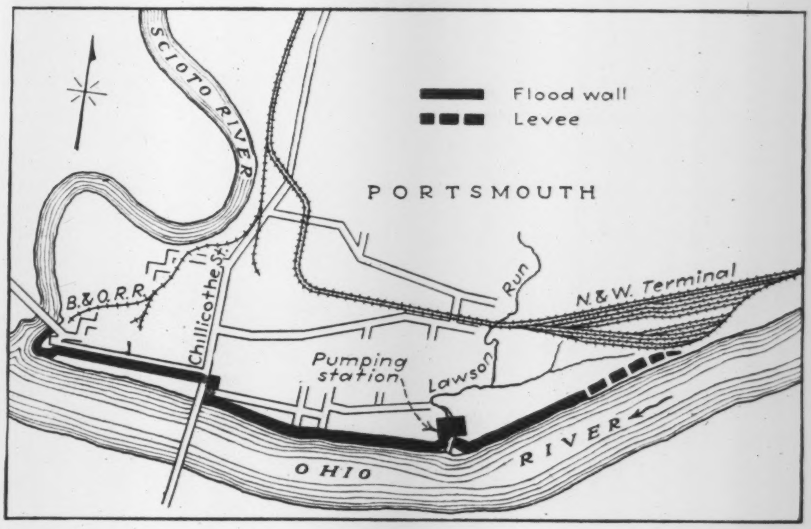
The concrete wall as noted above was built in three sections. Under Mr. Hudson's direction, the first section was built in 1908, extending from Chillicothe St. westward along the Ohio to and around the point on the Scioto River, a total distance of 4,500 ft. (*Engineering Record*, Dec. 27, 1913, p. 712). This first section gave protection to the part of the city west of Chillicothe St.

In 1916 the concrete wall was extended eastward from Chillicothe St. for 3,800 ft. under the direction of Samuel G. Harper, who was then city engineer. The second section gave only partial protection, and when the river rose to 57.2 ft. in January, 1927, it was necessary to place a sandbag levee 2 ft. high along a low part of Campbell Ave. to keep the backwater from Lawson's Run from entering the city. This situation emphasized the inadequacy of the protection, and when a bond issue of $350,000 for completion of the dike system was submitted in 1928, it was readily approved.

Two designs of wall

The first two sections were designed as counterforted retaining walls and are backfilled, except for a few short lengths, to 3 ft. from the top. The height of the wall varies from 10 to 22 ft. above footings, and counterforts are 10 ft. on centers. Design details are shown in Fig. 3. Although each sec-

FIG. 1—WALL AND LEVEE system including railroad embankments that surround Portsmouth, Ohio.



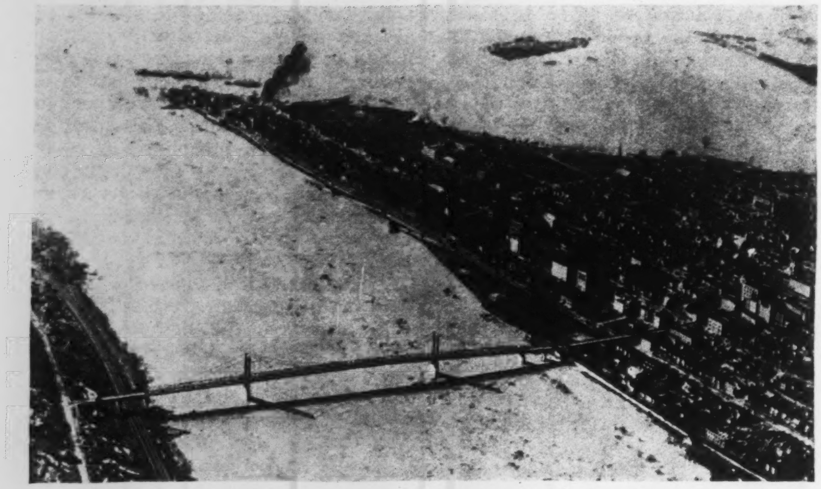


FIG. 2—FLOOD WATERS of two rivers piled up against its gates on March 22, but Portsmouth remained dry behind its river walls and levees. The Ohio River is in the foreground, and the Scioto beyond.

tion was poured continuously without expansion joints, the wall is in excellent condition today, showing little or no cracking due to temperature changes.

In considering the third and last section of the wall, a cantilever design was chosen instead of the counterforted type after careful investigation and study. Analysis of the counterforted type showed that the factor of safety against overturning was small, unless backfilled to within a few feet of the top. The cantilever design afforded a greater factor of safety with a minimum amount of backfill, and was also considered more economical to construct because of simplicity of form work.

Designs and specifications for the last section were prepared by the writers. Investigation of the soil along the proposed location of the new section revealed an alluvial deposit of clay and loam, unsafe for loads greater than 3,000 lb. per sq.ft. This was the determining factor for the width of footing required, designed to allow the resultant pressure on the wall to fall well within the middle third of the footing.

In addition to being designed to withstand the water pressure from the river, the wall was also designed to support an earth backfill to its top, as it was thought probable that in future years a boulevard would be built along the entire length of the wall. The specifications required a concrete of minimum strength of 3,000 lb. per sq.in. at 28 days. The average of all test cylinders was 3,450 lb. per sq.in.

The contract for this section, which included 6,560 lin.ft. of concrete wall varying in height from 15 ft. to 31 ft., and a dirt levee 940 ft. long at the east end of the wall, was let to the Portsmouth Contracting Co., of Portsmouth. A gap of 400 ft. was left at Lawsons Run, which, together with a pumping station and equipment, was built later.

The main wall was constructed in 40 ft. sections with an expansion joint every 320 ft., which was filled with premoulded joint filler. The forms were constructed in 20 ft. panels and lined with steel plates, which greatly reduced the labor of finishing the wall. Forms were stripped on the second day, about 40 hr. after pouring. Forms were used continuously, being moved ahead with a traveling crane. The varying height of wall was taken up by additional forms at the bottom of the standard section. Design of the third section is shown in Fig. 3. The total construction cost was $226,804.

Wall severely tested

The structure has had two very severe tests, on March, 1933, when the water reached a height of 60.7 ft., only 1.3 ft. below the top, and again on

FIG. 3—TWO DESIGNS of concrete wall are used: a counterforted type for the first two sections built and a cantilever type for the last section. The latter type is stable without backfilling, which was necessary on the first two sections that were built.

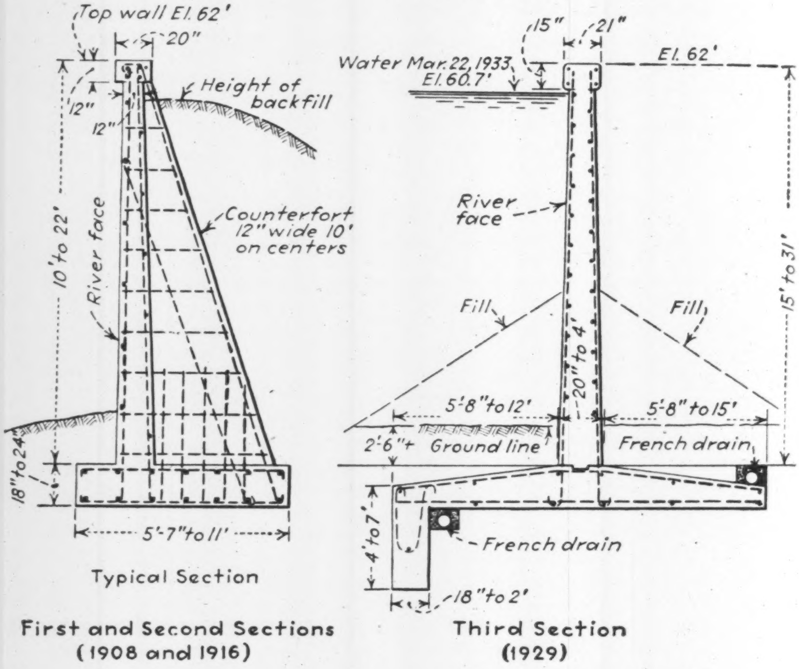
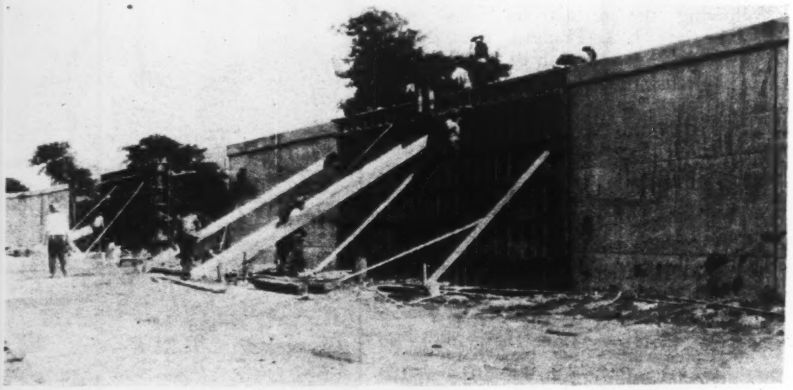


FIG. 4—PORTSMOUTH builds for its own protection. This is a view of construction of the third and last section of concrete wall built in 1929, completing the city's bulwarks against floods.



March 23 of this year, when it reached a crest of 59.36 ft. There can be no question as to its stability and ability to protect the city to a 62-ft. river stage. Some negligible seepage occurred through the expansion joints. This trouble could have been eliminated by the use of copper in the joints at the time of construction.

The French drains, which carried considerable seepage, presumably coming through the strata underlying the wall, as well as through the joints, caused some water to seep through the backfill and accumulate in two or three low places. While this caused no damage, it gave rise to many false rumors to the effect that the wall was failing. This trouble will be corrected by the construction of a sewer along the wall to carry this drainage to the pumping stations. There was also considerable seepage through the railroad fills, which consist mainly of slag and cinders. Sandbags were placed to counteract this to some extent. This seepage flows to the nearest sewers and is pumped out.

Provisions have been made to open the sewer gates and to flood the city gradually if the river stage ever rises above 62 ft. Thus it is apparent that fears of the city washing away from a rush of water over the wall is unfounded.

It is fitting to mention here that the city council, at its meeting on April 1, 1936, passed a motion to the effect that recognition be given to Mr. Hudson, by erecting a tablet to his memory.

Lift Span Erected by New Procedure

Harlem River crossing of Triborough Bridge in New York hoisted from barges to pier tops before end panels of 310-ft. trusses are erected—Counterweight movement controlled by jacks

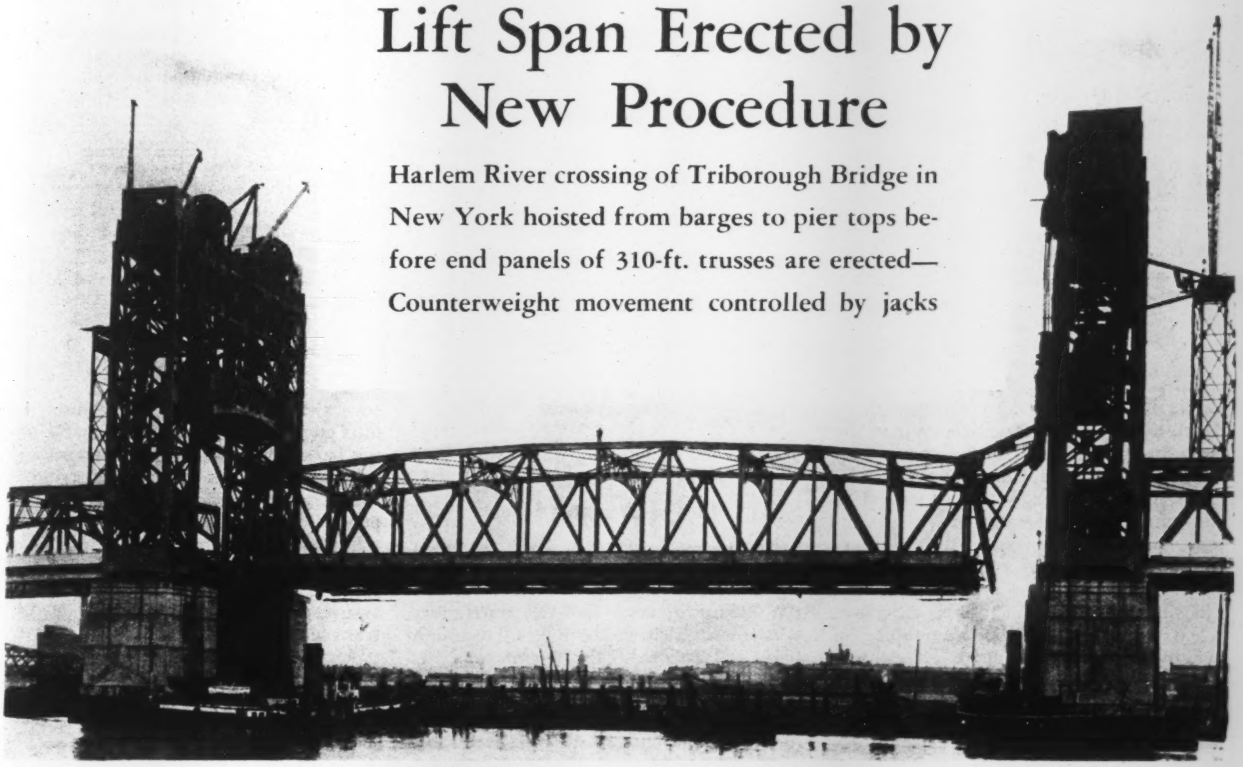


FIG. 1—RAISING the Triborough lift span by temporary outrigger connections to the lifting girders. The end panels of the trusses, missing in this picture, were erected as the next operation, to permit the span to be landed on the pier shoes.

LAST SUNDAY, May 3, the last stream crossing in New York's great Triborough Bridge project was closed when the 310-ft. lift span over the Harlem River in the Manhattan approach was floated into position between its towers, raised first to pier level and from there to its normal high position 135 ft. above the river. With the span in the up-position, the roadway wearing surface of asphalt plank and the concrete sidewalk slabs will be installed, to complete the bridge on schedule time.

The operations followed in erecting this huge span, which weighed 1800 tons as lifted, are noteworthy, and in some particulars departed from usual practice. One controlling factor was the 50-ft. height of the piers above the water, coupled with the fact that the lifting girder connections to the lift span had to be made at the bottom chord level. The contractor elected to float the span in at low level rather than to build the falsework on his barges high enough to clear the piers, and since the span was about 25 ft. longer than the clear distance between the piers, this presented another complication. By leaving off the end panels of the span until it had been raised clear of the piers, using temporary outrigger connections extending above the level of the top chords, these difficulties were overcome.

Largest in roadway area

The Harlem River lift span, joining Randalls Island on the east with Manhattan on the west, is believed to be the largest yet built when measured in terms of its roadway area which is 20,000 sq.ft. The span is 310 ft. and the trusses are spaced 75.5 ft. on centers, to accommodate two 30-ft. roadways separated by an island. Two 8.5-ft. sidewalks are carried outside the trusses. The weight of the completed span will be 2,050 tons. The 133.5 ft. towers, contrary to usual practice, are supported on the piers independent of the side spans, an arrangement adopted in the interests of architectural appearance. Each tower consists of two x-braced four column legs, 20x23.5 ft. in plan and 95.5 ft. on centers braced apart at the top by trusses 20 ft. deep. Machinery houses on the top of each tower enclose three 200 hp. motors, one of which is a synchronous motor through which the span is maintained level during lifting. Also, within these enclosures are located the four

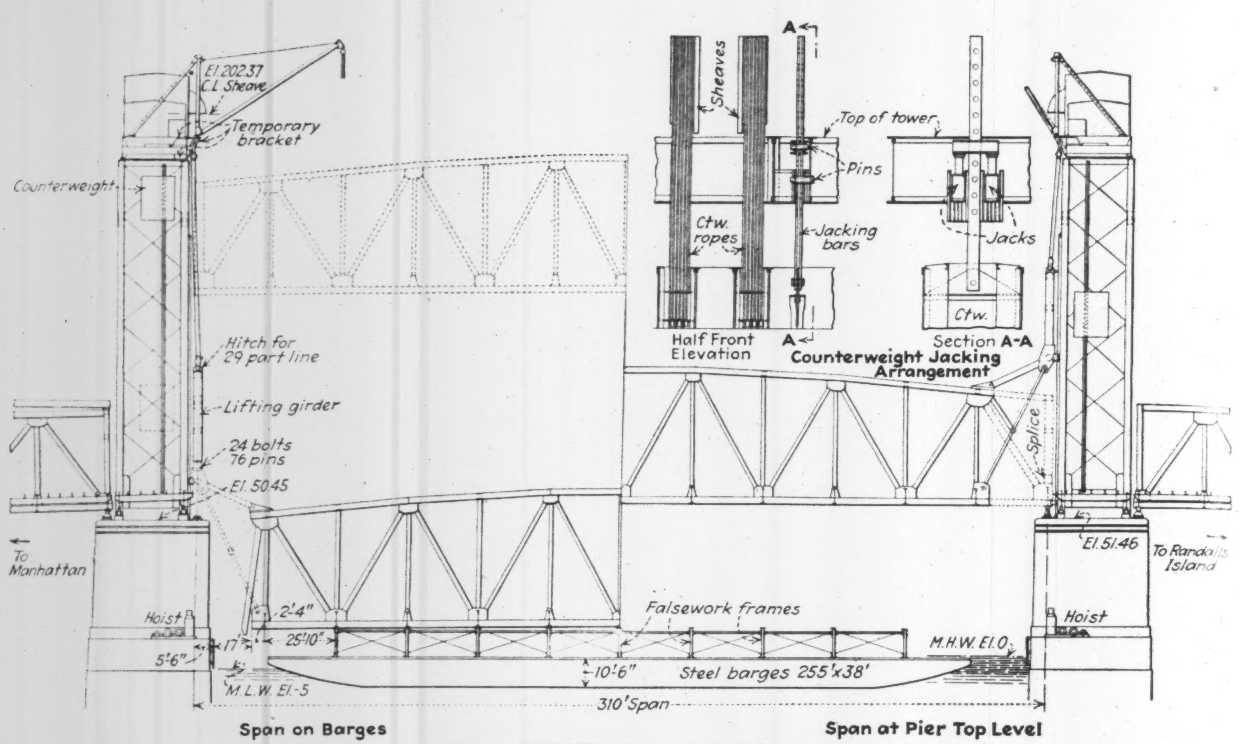

El. 202.37
C.L. Sheave
Temporary bracket
Counterweight
Hitch for 29 part line
Lifting girder
24 bolts 76 pins
El. 50.45
To Manhattan
Hoist
2'-4"
17"
25'-10"
5'-6"
M.L.W. El. -5
10'-6"
310' Span
Span on Barges
Sheaves
A
Top of tower
Pins
Ctw. ropes
Jacking bars
Jacks
Ctw.
Half Front Elevation
Section A-A
Counterweight Jacking Arrangement
Splice
El. 51.46
To Randalls Island
Falsework frames
Hoist
M.H.W. El. 0
Steel barges 255'x38'
Span at Pier Top Level

FIG. 2—DETAILS of raising operations followed on Harlem River lift span of the Triborough Bridge.

15-ft. dia. sheaves each carrying twelve $2\frac{1}{4}$-in. dia. wire ropes which engage the span through a lifting girder that moves up and down the face of the tower. The other ends of the ropes are attached to the counterweight located over the roadway; in its up position the counterweight is masked by the trusses across the top of the tower. The lift span provides a 55-ft. vertical shipping clearance when down and 135 ft. when up. An article describing the entire Triborough Bridge project was published in the issue of Aug. 8, 1935, p. 177.

Floor steel erected at rail-head

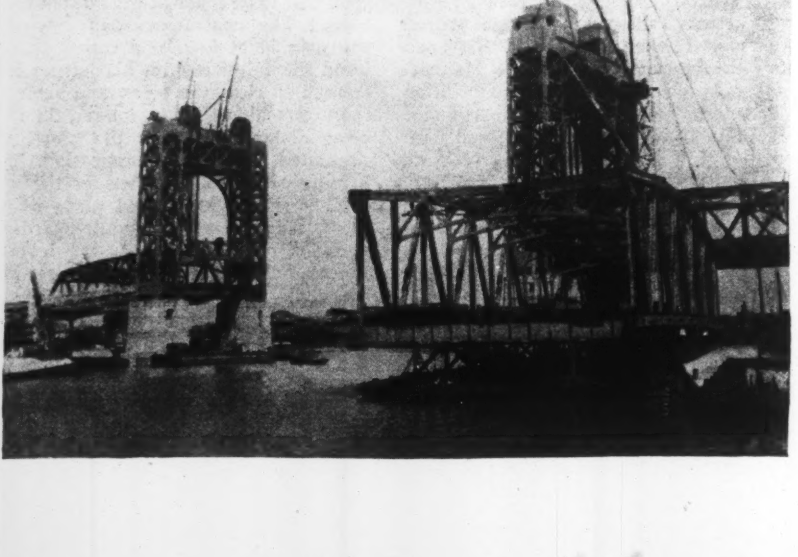
Steel for the lift span was received by rail at the Hudson River piers in Weehawken, N. J., on the opposite side of Manhattan Island from the bridge site. As it was unloaded, the steel for the floor members, bottom chords and lower lateral bracing, except the two end panels, was assembled in final position on falsework consisting of nine steel A-frames set up on two steel car floats 255 ft. long and 38 ft. wide fastened together side by side, 43 ft. on centers. The truss members and bracing were stowed on top of this platform, and the partially completed span towed four miles around the lower tip of Manhattan to a berth adjacent to the bridge. Here a guy derrick was erected on the Randalls Island approach span and the lift span assembly completed, minus the two end panels but including temporary outrigger connections extending upward and outward from the ends of the trusses. These outriggers were necessary because the span on the barges was only 13 ft. above the water and thus about 40 ft. below the top of the pier.

Towed in at low level

In this semi-complete state the span was towed into position between the towers, and a connection made between the lifting girders and the outriggers whose ends cleared the tops of the high piers. Previously the counterweights had been poured and were suspended several feet below their up-position from pins engaging temporary lifting or jacking bars. The counterweight ropes were in place but slack and not carrying the lifting girders, each of which was suspended from a 29-part line attached to a hoist set on the pier. The machinery, geared to the main sheaves, had been assembled locking the sheaves together, to assure that the span would remain level transversely while it was being lifted.

After the connection was made between the outriggers on the span and the lifting

FIG. 3—LIFT SPAN approaching completion on barges in the berth adjacent to Randall's Island. The barges were moved from time to time so that the derrick on the approach could reach all parts of the span.



girders, water was pumped into the barges to lower the span as an aid in making the slack counterweight ropes taut; this operation coincided with a falling tide which aided the lowering of the span and therefore also the lifting girders. Finally the counterweights themselves were lowered (using four 350-ton jacks on each operating against jacking girders attached to the lifting bars) until their weight was suspended on the counterweight ropes. In this condition the counterweights balanced all but 65 tons of the span load; this difference in weight was intentional, to eliminate any tendency for the span to move up without a definite force being applied. This span overbalance and friction were required to be overcome in lifting the span from the barges with the hoists on the piers.

After the span had been raised (in about 16 min. elapsed time) so that the bottom chords were level with the shoes on the piers, the end panels of the trusses were erected by lines from derricks on top of the towers, and the span was lowered slightly to bearing on the shoes. This permitted release of the outrigger connections, following which the Manhattan lifting girder was lowered (by jacking the counterweight up to its normal high position) until the permanent connection to the bottom chords could be made. This jacking operation raised the counterweight a total distance of 45 ft., pins being inserted in the lifting bars after each 2 ft. lift, to carry the load while the jacks were being reset. The counterweight was then lowered slightly putting the full load on the ropes. The operation of transferring the lifting girder connection to the bottom chords was then repeated on the Randalls Island end of the span

As a final operation the span was raised to its normal high position, using the temporary hoists and the 29-part lines that were attached to the centers of the lifting girders. The contractor was allowed to block the channel for 6 hr. and was required to have the span raised to its up-position in 48 hr. The time required to set the span on its shoes on the piers was 5½ hr. A storm on May 4 delayed final raising of the span until the morning of May 5.

It is believed that the Harlem River Bridge is the first lift spa.. to be completely assembled on floats, and also the first to be floated into position below pier level. The low level assembly was adopted to reduce the weight of falsework and to give better stability. Also, since the towers are independent of the approach spans, high level cantilever erection would have necessitated considerable temporary anchorage. In addition, cantilever erection would have interfered with the completion of the work at the tops of the towers and would have been more hazardous during the winter.

Personnel

The erection of the bridge was carried out by the Taylor-Fichter Steel Construction Co., New York. S. D. Kapelsohn, general superintendent. Clinton D. Hanover, Jr., and H. O. Adelman assisted in the development of the erection procedure. For the Triborough Bridge Authority, H. W. Hudson is construction engineer and Homer R. Seely, resident engineer. The lift span was designed by Ash, Howard, Needles and Tammen, consulting engineers, New York.

◆

Letters to the Editor

Welding Technique

Sir—In reading through the February 27 issue of *Engineering News-Record* we were very interested in the editorial "Don't Forget the Welders" on page 328. We were particularly interested in the last sentence of your editorial which read "A weld is only as good as the welder."

The welding industry has long recognized the importance of the welder and his qualifications but we believe that that is o.ly part of the story. There are five additional factors of importance, and grouped together, they are generally considered under the heading "Procedure Control." If the six steps of Procedure Control are followed there can be no result but a good weld. Procedure Control is not a new term nor are the factors which it covers by any means new.

The six steps of Procedure Control for welding are as follows:

A. Check of the Welders
   1. Experience
   2. Qualification Test
   3. Special Check

B. Selection and Inspection of Material
   1. Material to be Welded
   2 Welding Rod
   3 Welding Flux
   4. Gases
   5. Welding Apparatus

C Design and Layout of Welded Joint
   1. Spacing
   2. Welding Procedure

D Preparation for Welding
   1. Alignment
   2. Cleaning
   3. Packing

E Welding Technique, Organization and Construction
   1. Organization
   2. Welding Technique
   3. Construction Detail

F Inspection and Test
   1. Inspection
   2. Testing

Consideration of the above factors together with proper supervision will assure a thoroughly sound and satisfactory job for any type of welded construction. Our letter is not intended as a criticism but we believe it preferable to state that "a weld is as good as the procedure control and its application in the hands of the organization performing the welding" rather than to place the entire responsibility upon the welder himself.

R. W. BOGGS
The Linde Air Products Co.
New York, N. Y.
March 31, 1936.

THE EDITORIAL in question did not place "The entire responsibility upon the welder." Quite the contrary, for it stated that "prequalification tests for welders should be accepted as a permanent part of all welding routine." Adherence to the above procedure control steps will unquestionably produce a sound weld. It is to be noted that steps A, D and E are direct corollaries of the welder's ability, however. —EDITOR.

Soil Tests and Foundation Design

Sir—Bruce M. Dack's letter published in your issue of April 9 emphasizes the futility of detailed earthquake-resistant design when erroneous assumptions as to foundation conditions are made. It might also be added that normal designs for vertical loads are frequently invalidated by unnecessary foundation settlements.

Tests can be made which reveal the elastic characteristics of soils under oscillating loads, simulating earthquake conditions, as well as for normal static loading. The results of these tests have been and are being used by progressive engineers in order to obtain adequate and economical foundations.

The common error into which all too many engineers and architects fall is the failure to distinguish between soil testing and foundation engineering. In order to be useful, a soil test must be located and conducted under the supervision of a competent engineer who has an intimate knowledge of the sub-surface structure, including variations in moisture and density which affect the supporting value of the soil as well as the types of soil present. A test made with incomplete understanding of the situation is likely to be unrepresentative of the conditions to be met by the proposed structure.

The importance of accurate interpretation of the test results must not be underestimated. This study must be undertaken with due consideration to the type of soil and the structural features of the proposed building, in the light of our best knowledge of soil mechanics. The understanding of stress in soils has advanced so rapidly that it is not too much to say that even now it is possible and economical to improve greatly the precision of foundation design both for normal and earthquake loading, and in the near future it is hoped that a more consistent accuracy of design throughout the structure may be common practice.

WILLIAM W. MOORE
Los Angeles, Calif.
April 14, 1935.

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May 7, 1936

Mendicancy in Fashion

IMMEDIATELY after the March flood waters went down the officials of a substantial Pennsylvania city set about surveying the damage done to their public property. They were gratified to find only minor damage, such as a few stretches of street surfacing washed and some public buildings begrimed by mud. Nevertheless the mayor promptly called on the federal government for a flood-relief contribution. He admitted that the city's loss was not large enough to require aid, but said that since other cities were getting federal money his city was also entitled to its share. A plainer case of the mendicancy abroad among our municipal governments could hardly be found. The habit of turning to the federal treasury for any requirement that may come up has become an evil fashion—the product of spinelessness and moral weakness of public officials. The taxpayer gains nothing by it; he must foot the bill in any case, whether directly through the municipal treasury or in a roundabout way through federal tax payments.

Self-Protection Succeeds

IN CONTRAST, witness the case of Portsmouth, Ohio. For generations menaced each year by the floods of the Scioto and Ohio rivers, its citizens no longer fear that muddy waters pouring into their homes and business establishments may convert their possessions into a mass of sodden wreckage covered with mud and filth. Thirty years ago an energetic city engineer, the late J. I. Hudson, convinced the authorities that such happenings could be prevented and despite the opposition of short-sighted citizens he started the first section of a flood-wall protection system. Soon opposition turned to enthusiastic support, and this spring, after the latest flood test, when the highwater of the Ohio once more swept harmlessly past the wall, a grateful citizenry voted a plaque to be erected in Hudson's memory. For a total investment of only $650,000 Portsmouth saved itself millions of dollars of losses. Only once has the wall been overtopped, and that in the historic 1913 flood; in other years the rivers rose above street level time and again, yet the city and its inhabitants remained dry and unharmed. A remarkable feature of the case, according to current notions, is the fact that the citizens regarded flood protection as their own local problem, something to be built and paid for by themselves. And the same view was taken by their neighbors to the westward in the Miami valley a few years later. The flood-harassed people of those days believed that flood-protection meant self-protection, and the event vindicated their belief.

A Wet Tunnel

WHEN A TUNNEL is "wet" to the extent of 14,500 g.p.m. and when such inflows are continuous in headings driven from the bottom of a shaft 800 ft. deep, extraordinary measures are required. This is the situation in east Potrero heading of the San Jacinto tunnel. Pumps able to handle such quantities under so high a head are not often needed on construction work. In this tunnel the quantity of inflow justified a subterranean pump station not only to make heading advance possible but also to give confidence to men working far below the surface in a veritable subterranean river subject to sudden flood. When the heading driven downgrade to the west from Potrero shaft was holed through recently, means for letting water escape by gravity via the west portal was provided and much of the risk so far as the human element is concerned was removed. Subsequent to this holing through a line change has been announced which is expected to speed up the work by adding new points of attack through another adit. Meantime, grouting is a major feature of advancing the heading eastward from Potrero shaft. The three methods of grouting to seal off the flow include schemes developed expressly for the job, as described in this issue. Grouting has become a major factor in the problem of completing one of the most difficult tunneling jobs ever undertaken.

Still a Chance

PROBABLY MOST MEN, engineers included, find a topographic contour map to be a rather hopeless jumble of lines decipherable only by painstaking study, and rarely of practical use when quick results are wanted. It would be unreasonable to expect Congressmen to appreciate the importance of making such maps, and the record shows that time and again they have refused to become enthusiastic about proposed surveying and mapping programs to complete our unfortunately very fragmentary national topographic map and its control system. Whenever a specific project of construction has to be undertaken, Congress is willing that all necessary money be used for hasty surveys and mapmaking, even though the cost be needlessly high and the construction work itself be delayed by the necessity for preparing maps in advance. But funds to finish up our general mapping program in reasonable time have never been granted. However, there is still a chance that the necessities of the mapping program will find recognition before long. Senator Hayden's resolution asking for an "economical" program to be presented to Congress next January may have the result that some serious consideration will be given to the importance of the subject to national interests. The report might perhaps be assured of a better hearing if it included proposals for making topographic maps more readable and popularize them. Above all, however, the need for completion of the national survey deserves early recognition.

Let Useful Work Proceed

EVER SINCE the beginning of the public-works campaign, nearly three years ago, road construction has been the chief job-creator. It made a brilliant record in the 1933 campaign, under the $3,300,000,000 bill, and would have done even better under the four-billion-odd act of 1935 had not action been retarded until near the close of the season by the President's delay in releasing funds. Further testimony to the efficiency of road work in respect to employment has recently been given by Harry Hopkins, who singled it out as the best type of WPA work. This cumulative testimony makes it particularly gratifying to learn that the federal-aid highway bill is nearing enactment, having received the approval of the Senate committee. It not only authorizes adequate appropriations for 1938 and 1939 but also provides for an immediate start on work with the money available this coming July. The constructive value of this measure is the greater because of the dispute over the question whether the new relief fund shall be idled away by WPA procedure or whether a substantial part shall go to permanent work of a kind that will restore normal activities and employment. The highway bill is the first and most important element in constructive continuation of an efficient reemployment campaign, and any help that engineers and others of the construction industry can give to make sure of its passage will be well worth while. In equal measure, however, their aid is needed to bring about sound action on the relief fund: to insist that all or a substantial part of the fund be allocated to the Public Works Administration for needed improvement projects designed and built by competent, normal methods.

A Chaplet for Soils Research

IT IS ONLY a little more than ten years since American engineers were introduced to a new science in embryo—the science of soil action. Its engineering implications were realized at first only by a few earnest workers, but they made up in energy what they lacked in numbers. Through their efforts knowledge of soil mechanics soon began to take practical form. Disciples gathered, and the work of research and education went forward with gratifying momentum.

How far knowledge has been carried in a decade is indicated by the account of the soils laboratory work for the Muskingum dams that is concluded in this issue. Here soil mechanics, barely accepted as a promising speculation in physics in 1925, manifests itself as a practical working tool of the earth dam-builder in 1935. And while roadbuilding and foundation construction also show large results, it is the problem of building earth dams that presents the most severe test of the science of controlled soil action.

It has been said that of all the empirical methods used in earth and foundation engineering those used in the design of earth dams are the most unreliable. In a large way the work of the engineers at Muskingum, succeeding that of R. R. Proctor for the dams of the Los Angeles county flood-control, has begun to write empiricism out of the practice of earth dam building. The change is a revolution in practice made possible by the labor of the research workers, the pioneers and their disciples, who fought first for recognition of a new science and later developed the technique of its application in embankment and foundation construction.

Engineering News-Record takes pride in having been able to open the way of publication for the records of this labor, from the first announcement of the research work of Terzaghi in 1925 through the subsequent work of Terzaghi, Hogentogler, Gilboy, Eno, Housel, Casagrande, Proctor, and now the engineers of the Muskingum River flood-control works. Next month an international conference on soil mechanics at Harvard will aid further in marking out the long road of progress that has been covered in these few years. And, by bringing together in coherent record the advances now being made by workers throughout the world, from Orient to Pacific, it will prepare a solid foundation for the coming larger structure of engineering command of soil action.

Facts on Housing Needs

IF ANY SKEPTICS still doubt the need for action on housing, let them consider current statistics. Hard facts are given by recent Cleveland figures from the Real Property Inventory—the only illuminating figures available because Cleveland is one of the few cities that inventory the condition of their buildings each year. The latest data present a startling picture.

Since 1932 the housing vacancies in Cleveland have dropped from 9 per cent to 3 per cent (7.4 in 1933, 4.7 in 1934). Even on the face of the figures this represents an undersupply, as the normal minimum of vacancies is usually rated at 4 to 5 per cent. But the situation is even worse, for with 9,765 family units now vacant out of 314,220, there are 8,851 families doubled up. And since the last three years have seen the process of undoubling going on rapidly it is likely that soon all these families will once more set up for themselves. There is a real housing shortage in Cleveland—and so for every other city in the country, as is known from real estate experience.

For some years fewer houses have been built than the number of old ones that went out of service. Cleveland's figures show that in four years 2,417 new family units were built, while 3,004 were torn down in the same time. The available housing thus actually decreased, and at the same time the city's population grew by several thousand families. But the number of houses available is subject to a heavy discount for dwellings unfit for habitation or obsolete to the degree of not meeting even minimum requirements. A special count in 1934 showed nearly 9,000 family units to be unfit for human habitation, while thousands more lacked bath and indoor toilet facilities.

In these last-stated facts lies the prime incentive for effort to promote housing construction. And further, they embody the essential explanation of why housing progress has been confused and abortive. So long as the slums, the firetraps, the pestholes of disease and degradation are allowed to survive, their owners will prefer to draw profit from them and will not move to build something better.

At the meeting of the Chamber of Commerce of the United States last week, realty men once more asserted, as they have before, that private effort can be depended on to re-house the nation and that there is no need for government action to promote good housing. But they offered nothing that promised a change from the conditions of today and of many years past—no elimination of slums and firetraps, no assurance of substantial building, not even their support of better laws and more consistent law enforcement. They argued only for retention of the system under which unfit housing has come to be recognized as a national evil. So long as this attitude continues the much-to-be-wished-for return to wholly private housing intiative is certain to be delayed.

Absence of laws, inadequacy of laws and negligence in enforcing such laws as protect minimum housing standards are the curse of the housing situation. There would be less need for the "social housing" movement, and a far stronger argument for leaving the entire housing problem to private enterprise, if building and sanitary laws were everywhere adequate and city officials enforced them. So long as they do not, the building of new housing worthy the name of a civilized age is under too great a handicap of competition by the owner and exploiter of slums.

CURRENT NEWS

Highway Aid Bill Reported Favorably

Immediate apportionment of $125,000,000 required in federal-aid highway bill—Funds for grade crossings included

Washington Correspondence

THE federal-aid highway bill authorizing appropriations of $125,000,000 each for the fiscal years 1938 and 1939 was reported April 30 by the Senate Committee on Post Offices and Post Roads. Besides extending regular federal-aid for a period of two years, the bill requires immediate apportionment among the states of the $125,000,000 authorization for the fiscal year 1937, which has been held up by executive order of President Roosevelt until July 1 next. The bill also provides that projects approved by the Bureau of Public Roads under such apportionment before July 1, the beginning of the new fiscal year, may be contracted for immediately by the states and construction begun. Speedy enactment of the bill is hoped for, consequently, in order that the states can get started on the new fiscal year's program early in the construction season. The bill passed the House on April 16.

Authorization of $25,000,000 in each of the fiscal years 1938 and 1939 for secondary and feeder roads, including farm-to-market, R.F.D. and school bus routes, anticipates growing agitation for extension of federal-aid to county road construction. County funds may be contributed to help the state match the federal allotment for farm-to-market roads but selection of projects remains in the hands of the state highway departments. The Senate committee struck from the House bill a provision for establishment in the Bureau of Public Roads of a section of Rural Roads. Thomas H. MacDonald, chief of the Bureau, informed Senator Hayden, chairman of the Senate Committee, by letter April 23, that this provision is not desirable at this time, pointing out that the Bureau is now engaged in cooperation with many of the state highway departments in an inventory of existing rural roads to which several sections of the Bureau have been assigned. It will be a year or more before the survey is completed.

This is expected to establish a basis for future administration of secondary road construction. In the meantime, the Works Progress Administration is engaged on an extensive program of rural road construction, having expended about $150,000,000 for this purpose to date.

The Senate Committee revised and restored to the bill a provision permitting expenditure, by a state, without matching, of that part of its federal apportionment which it may be unable to cover after applying the proceeds of its motor vehicle taxes to highway purposes other than construction. This provision is limited to the fiscal years 1936 and 1937.

The Senate committee increased from $10,000,000 to $20,000,000 the authorization for forest highways in 1938 and 1939, with the prospect that the conference committee of House and Senate will compromise on $15,000,000. The Senate committee restored a provision authorizing $10,000,000 in each year for the construction of parkways to give access to national parks, also $4,000,000 in each year for construction and improvement of Indian reservation roads.

Under a provision embodied in the bill by the Senate committee no federal-aid appropriation may be expended on any highway not equipped with proper safety devices at railroad grade crossings. The bill authorizes appropriation of $50,000,000 for grade crossing elimination in 1938 and 1939. These funds do not have to be matched by the states.

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Little and Ruggles Leave AWWA

It has just been announced that Beekman C. Little, for more than ten years secretary of the American Water Works Association, retired from active duty on May 1. Percy S. Wilson, who was formerly connected with the Association's trade recovery committee, enters the staff as acting secretary. W. N. Niesley continues in his position as administrative assistant to the secretary.

Arthur V. Ruggles, technical assistant to the secretary since 1928, also retired from the staff on May 1. Mr. Ruggles will continue his work on specifications for cast iron pipe and fittings as executive assistant to T. H. Wiggin, chairman of the American Standards Association's sectional committee on this subject. He will be located at the office of the secretary of the committee, C. C. Simpson, Jr., Engineer of Distribution, Consolidated Edison Co., 130 East 15th St., New York City.

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Flood Bills Reported by Congressional Committees

Approval has been given the $272,000,000 Overton bill for flood control works and levees on the lower Mississippi River by the House Committee on Flood Control. As the measure has already been passed by the Senate, it is predicted that it will become law well before the end of the present session. Some opposition is expected, but not enough to threaten seriously a favorable House vote.

Prospects are not so promising for the omnibus rivers and harbors authorization bill, which was reported favorably April 25, carrying projects totaling $360,000,000, including many Eastern flood control projects not included in the House version of the bill, passed last session. In order to bring the amount down to a reasonable figure the Senate Commerce Committee found it necessary to cut some projects, and an endeavor to restore some of the deleted projects is expected.

Power Agency Urged For Northwest

Federal agency to distribute Bonneville power recommended by National Resources Committee

IMMEDIATE CREATION by the present Congress of a federal corporate power agency in the Columbia Basin and further consideration of other development problems affecting the Pacific Northwest were recommended to President Roosevelt on May 6 by the National Resources Committee. The recommendations made by the national committee are based on a recent report of the Pacific Northwest Regional Planning Commission which proposed that such an agency be established.

Pointing out that Bonneville power will be available within eighteen months, the committee emphasized the need for legislation in the present session of Congress in order that the agency might be established without delay so that it might immediately begin the study of alternative possibilities of rate structure in relation to industrial and economic problems in the Northwest. A three-man agency is suggested by the National Resources Committee to develop the social and economic phases of the power development at Bonneville and ultimately at Grand Coulee.

Grid system proposed

In outlining the powers for the proposed new agency the resources committee included distribution of power and the establishment of rates to encourage broad regional use, as well as incidental powers concerning construction of transmission lines, purchase or condemnation of lands and other activities necessary to the development of markets and the distribution of power. The national committee also concurred in the recommendation of the regional commission that a super-power, or grid system, of connected transmission lines be constructed.

A policy for the sale of electricity that would make rates similar over large areas and which would pass along the economies in the prices of wholesale power to the ultimate consumer was recommended. It was pointed out that this policy should contribute, in so far as may be wise, to the stabilization of existing communities, the appropriate decentralization of new industries, the increase of steady employment and the increased consumption of electric energy by farmers and domestic consumers.

Development of forest resources

In order that lumbering, the chief industry of the Pacific Northwest, may be maintained and developed, the committee believes a policy of intensive management for sustained yields should be applied to private and public forest areas. In the development of irrigation projects their economic feasibility and advantages should be appraised by the regional planning commission in conjunction with the Departments of the Interior and Agriculture. Regional benefits from the projects undertaken through interstate cooperation or federal assistance should be secured to the whole region through federal or interstate operating agencies. A continuous regional planning activity should be provided through cooperation of state planning boards and federal officials and through continued federal financial assistance to the regional planning commission, according to the report.

War Department operation proposed

On April 29 companion bills were introduced into both the House and the Senate, providing for the completion, operation and maintenance of the Columbia River locks, dams and power plants by the War Department under the supervision of the Chief of Engineers. Under the terms of the bills, the Federal Power Commission is to determine that part of the cost of the entire project allocable to power development and to determine rates and allocations of power to purchasers. In order to provide a market for the power developed, the Secretary of War is authorized to acquire any property necessary to carry out the provisions of the act.

Funds for PWA Seen Unlikely

Contact by the public works bloc in Congress with President Roosevelt and with administrators, Hopkins and Ickes, has failed to produce any assurance that a portion of the pending $1,500,000,000 appropriation for WPA may be earmarked for continuing the PWA non-federal public works program.

The bloc headed by Rep. Beiter, of New York, is still publicly talking in terms of a $700,000,000 split for PWA but will bargain for $400,000,000. The petition demanding continuation of the PWA program carried 154 names May 4, but apparently has been nipped by House leaders, who are reminding individual congressmen that the President deferred to their opposition to a drastic reduction in CCC camps and that they could show their appreciation by not participating in the drive for more public works money.

Administrator Ickes charged, on May 5, that part of the delay in putting PWA's current program into construction was due to the bottleneck in clearing projects through Administrator Hopkins and Comptroller General McCarl last fall. Mr. Ickes reiterated that he had no connection with the public works bloc in Congress.

President Roosevelt repeated, on the same day, his opposition to earmarking $400,000,000 for PWA projects, explaining that if grants and loans were made for this purpose to municipalities the amount for relief would be reduced to the same extent. President Roosevelt concurred in the proposal by William Green, President of the American Federation of Labor, that PWA projects might be financed through loans from RFC. Lacking a grant, however, it is difficult to see how this would offer any inducement. Other alternatives suggested by Mr. Green to earmarking relief works funds for PWA included a specific additional appropriation for this purpose and a suggestion that PWA be allowed to apply to new projects, funds previously allotted to projects either withdrawn or rescinded.

Associated General Contractors Discuss PWA, Day Labor and Social Security Laws

Opposition toward the use of force account, or day labor, by government agencies on construction work decided upon at Spring board meeting of Associated General Contractors of America in Washington

The Spring board meeting of the Associated General Contractors of America, Inc., held in Washington, D. C., on April 28-29, 1936, examined into the inroads that day labor policies of governmental agencies are making into the public construction market and enunciated a policy of militant opposition towards governmental agencies or bodies prosecuting construction work by the day labor or force account method, for both now and in the future.

Col. Horatio B. Hackett, assistant administrator, Public Works Administration, accompanied by Howard Gray, director, Inspection Division, PWA and Edward H. Foley, director, Legal Division, PWA, met with the Board for a frank discussion of the problems arising between contractors and PWA. As a result of this discussion special contact committees were announced, composed of Col. Hackett, Mr. Gray, A. R. Clas, director, Housing Division, PWA, for the Public Works Administration and E. P. Palmer, chairman, George P. Zouck, F. L. Shackelford and E. P. Forrestel, from the A.G.C. for the contractors.

The A.G.C. will immediately proceed to conduct a survey to disclose major difficulties encountered by contractors in the execution of PWA work and request suggestions as to appropriate remedies. With this information, the two committees will endeavor to improve conditions.

Congressman Alfred F. Beiter, of New York, addressed the Board and advised of the progress that is being made in Congress to provide additional funds for PWA. He expressed his appreciation for the support which the Association is giving to this movement.

Looking to more satisfactory regulations in highway construction, the highway members of the Board met with representatives of the American Association of State Highway Officials, led by E. C. Lawton of New York, chairman of that Association's Committee on Road Construction, and as a result a special joint committee was established of which Mr. Lawton is chairman, to study and make recommendations concerning hours of employment and other working conditions in connection with highway construction. This joint committee includes representatives from the American Association of State Highway Officials, the Bureau of Public Roads and the A.G.C. H. P. Zachry, of Laredo, Texas and Richard L. Hopkins, of Albany, N. Y., were appointed to represent the contractors.

Proposed revisions of the American Institute of Architects' standard building contract form and general conditions were submitted to the Board, which were approved with certain reservations. These were referred to the American Institute of Architects for final action on these changes at its meeting at Williamsburg, Va., the week of May 4.

Social security forms approved

The latest developments in the social security laws as they affect contractors were reported upon and discussed. The standard A.G.C. pay roll and record forms for the use of its membership in connection with these measures were reviewed and approved.

The Board gave its attention to the increasing cost of accident compensation and decided upon an intensified safety campaign and directed the gathering of information relative to the costs of compensation insurance.

O. W. Swenson, of New York, was selected as chairman of the Heavy Construction and Railroad Contractors Division of the Association.

W. A. Klinger of Sioux City, Iowa, president of the A.G.C. presided at all meetings. E. P. Palmer of New York, N. Y., vice-president-at-large, reported upon the trend of taxation, both as to amount and types of taxes. Edward J. Harding, managing director, presented a full report of the activities of the association since its annual convention held in January at Miami. George B. Walbridge, chairman of the legislative committee, reported on the legislative situation and the activities of the association in connection with all matters affecting contractors. The time and place of the Fall board meeting was left in the hands of the executive committee.

TVA Transfers Equipment; Power Lines Bought

The Tennessee Valley Authority is moving the rock crushing and concrete materials handling plant, now at Norris Dam, to the site of the Chickamauga Dam near Chattanooga, Tenn., in accordance with its policy of transferring heavy equipment to other points after it has served its purpose where first installed. In the building of the Pickwick Landing and Guntersville dams, some of the equipment purchased originally for Wheeler Dam, which is now nearly completed, will be used. It is estimated that the use of the rock crushing plant at Chickamauga after its service at Norris Dam will save about $118,000. The Norris plant consists of a primary crusher, a secondary crusher, a classification plant which screens the crushed rock into four sizes, four hammermills and a system of belt conveyors which tie these units into an integrated plant.

Formal completion of the transaction which led to the recent Supreme Court case challenging the constitutionality of the Tennessee Valley Authority occurred last week when TVA took over from the Alabama Power Co. transmission lines leading from Wilson Dam to the city limits of Decatur, Russellville, Red Bay, Athens, Florence, Sheffield and Tuscumbia, Ala. It also acquired from the company some 1,600 acres of land at the site of the Joe Wheeler Dam. TVA paid about $1,150,000 for the properties.

Elk City Earth Dam Fails During Deluge

Long, low embankment in Oklahoma washed out at midpoint as spillway proves inadequate to pass cloudburst storm

THE LONG, low earth dam forming part of the waterworks of Elk City, Okla., failed about 1 a.m., May 1, when the spillway was unable to pass a cloudburst flood and the structure was overtopped. According to preliminary reports sent in by W. C. Burnham, of the State Conservation Commission, and W. R. Holway, consulting engineer, of Tulsa, the dam was overtopped to a depth of 18 in. for its full length of 2,019 ft. before a 150-ft. section at the center gave way. Late in the evening of April 30 a violent rainstorm struck the vicinity. At the dam the rainfall was 5¾ in. in two hours, of which 3½ in. fell in 45 min. Reports from the drainage area above the dam indicate a total fall of 8 in. during the evening.

Spillway capacity reduced

The dam was built in 1925, founded on Permian Redbeds shale containing vertical fissures as well as horizontal bedding. A concrete slab covered the upstream face, built on a 3:1 slope; the 2:1 downstream slope was sodded. Maximum height of the embankment was 20 ft. When built the spillway was about 5 ft. deep, providing a capacity of 10,000 sec.ft. of water before the dam was overtopped. Three years ago the lip of the spillway was raised 2½ ft., cutting the spilling capacity down to 4,400 sec.ft. At the new spillway level the reservoir covered 90 acres, and held 600 acre-ft. of water. The reservoir was practically empty at the start of the storm.

The maximum runoff during the storm, from a drainage area of 12,500 acres, is estimated between 15,000 and 18,000 sec.ft. A runoff from a rain of 0.6 in. would have filled the reservoir. Besides the main break, the dam was nearly washed through in several other places, and the whole downstream slope is badly eroded from overtopping. Last year the dam was overtopped with slight damage.

Other than damage to the structure, the rush of water caused little loss except to crops and highways. There are no houses or other structures in the valley below the dam.

In 1934 the reservoir went dry, and the city dug three wells below the dam and two in the reservoir area to supply additional water. These were all flooded out, but were soon partly restored to service, averting a serious water shortage for the town. A $350,000 PWA project is now under way to provide additional supply from wells in the Red River valley, 12 miles away.

Bills of Engineering Interest Signed by Roosevelt

A joint Congressional resolution providing for investigation of means for increasing the capacity of the Panama Canal for future needs of oceanic shipping has been signed by President Roosevelt. He also signed an act granting consent of Congress to the Missouri State Highway Commission to construct a free highway bridge across the Current River in Shannon County. Similar consent was also granted to Mississippi for construction of a bridge across the Pearl River near Monticello, and the Delaware River Joint Toll Bridge Commission of Pennsylvania and New Jersey was authorized to construct a toll bridge across the Delaware River near the Delaware Water Gap.

A favorable report was submitted by the Committee on Rivers and Harbors to a bill which would permit the city of Buffalo, N. Y., the right to occupy and use for sewage-disposal facilities part of the lands forming the pier and dikes of the Black Rock Harbor improvement. Rep. Maverick introduced a bill providing for an appropriation of $1,950,000,000, of which $1,400,000,000 would be for the WPA and $450,000,000 for the PWA. A bill to stabilize the structural steel fabricating and erection industry, introduced by Rep. Wood, was referred to the Committee on Interstate Commerce. A bill calling for the payment of the prevailing union wage scale on government contracts was introduced by Rep. Ayers, and a bill to provide for the protection of workmen on public buildings was introduced by Mr. Connally.

REA Suspends Activities In Virginia

Complete suspension of all operations of the Rural Electrification Administration in the state of Virginia, pending clarification of the attitude of its Corporation Commission toward the REA program has been announced by Morris L. Cooke, REA Administrator.

This suspension follows the action of the Commission, on April 30, directing the Virginia Electric & Power Co. to construct an extension of its system from Fredericksburg to Chancellor. The new line would serve part of the territory included in the plans of the Farmers Rural Utilities, Inc., which on Jan. 24, 1936, was granted a loan of $366,800 for the construction of 406 mi. of distribution line to serve 1,511 rural customers. Construction had already started on a part of this project.

Issuance of the Commission's order followed the filing of two petitions by farmer groups requesting that they be served by the Virginia Electric & Power Co. rather than by the REA cooperative organization. The Commission granted the petition from the Chancellor area, but denied that from the vicinity of Doswell. According to REA, these two areas represented the most profitable sections of the cooperative project, and were depended upon to make economically possible service to the more thinly-settled districts.

Mr. Cooke pointed out that the power company had acquiesced in the shaping of the cooperative project and is still, according to his understanding, willing to refrain from entering the territory which it covers.

Besides the Farmers Rural Utilities loan, the present suspension prevents completion of negotiations on two others for which funds are available; two additional projects for which allotments were in process of being sought, and fifteen pending applications. In all, these projects cover about 3,300 mi. of line to serve more than 16,000 rural customers.

Chicago Regional Planning Association Meets

Progress on various projects suggested and worked on by the Chicago Regional Planning Association was reported, May 1, at the thirteenth annual meeting by Robert Kingery, secretary. Ten grade separations were built in the 5-year period prior to 1931 and 60 have been constructed since. Uniformity of traffic markings has been universally adopted in each of the three states and thirteen counties of the region.

There are now 3,867 mi. of pavement in the region outside of Chicago, of which [illegible] mi. provide for four-lane traffic and the remainder for two lanes. Stream-pollution improvement and bank clearing have been accomplished on the Des Plaines, Salt Creek, Fox River and Little Calumet through the cooperative efforts of the state and county boards of health, park and forest preserve officials. DuPage County is the first county in the region to put into effect zoning for unincorporated areas. Parks have increased from 10,000 to 14,000 acres and state and county forest preserves from 35,000 to 45,000 acres.

John Wheeler, Indiana state highway commissioner, in speaking of safe roads indicated that Indiana has completed essentially all of the through routes, including widenings and grade separations around the foot of Lake Michigan as proposed by the Regional Planning Association.

Ralph Budd, president of the Burlington Railroad, in his talk on the relation of the new high-speed trains to regional design, stated that there will be little effect, since the high speed is obtained largely by eliminating stops, which can not be done in suburban service.

D. H. Burnham was reelected president and Robert Kingery, secretary.

New Adit Facilitates San Jacinto Tunnel Work

The board of directors of the Metropolitan Water District of Southern California, in an effort to speed up the excavation of the 13-mile San Jacinto tunnel, major remaining underground section of the Colorado River aqueduct project, has authorized the construction of a new inclined adit to provide two new working faces in the bore. The alignment of the tunnel will be changed slightly, adding about 900 ft. to its length, to facilitate the construction and utilization of the new adit. The change of procedure was authorized by the board on the recommendation of F. E. Weymouth, general manager.

The new adit will be located in Lawrence Canyon, about four miles south from Banning, Calif., and will give access to the line of the tunnel almost exactly midway between the Cabazon shaft and the Potrero shaft. The line of the tunnel will be brought slightly northward from the portals to the point of intersection with the new adit. Machinery and supplies are being hauled to the adit portal site and preparations are being made for the erection of necessary camp buildings. Construction of the San Jacinto tunnel is being carried forward by forces employed directly by the Metropolitan Water District. C. R. Rankin is general superintendent of this aqueduct unit and E. E. McCabe, tunnel superintendent. on the work in Lawrence Canyon.

Western Highway Officials Hold Convention at Phoenix

Highway problems peculiar to the Western states were the chief topics of discussion at the annual meeting of the Western Association of State Highway Officials, held at Phoenix, Ariz., Apr. 29-May 1, with more than 200 in attendance. Principal speakers included L. I. Hewes and R. E. Toms, of the Bureau of Public Roads, J. W. Powers, of the Arizona Highway Department, Gibb Gilchrist, of the Texas Highway Department, and Willard Chevalier, publishing director of *Engineering News-Record* and president of the American Road Builders Association. Mr. Gilchrist urged a greater expenditure by the federal government upon roads in the less-populated western states, declaring that the building of roads through these districts was in the long run a benefit to the richer eastern states by opening up greater trading areas. He declared that the day of financing road construction through state bond issues was past.

Diversion of gasoline taxes was branded as a "vicious, unfair method of taxation of the motorist" by Col. Chevalier, who also stated that the states must re-assert their independence by supplying road funds to cooperate with the federal-aid roadbuilding program, which he praised highly. In deploring the trend of roadbuilding to relief-work status, he declared: "It's time for restoration of normal procedure in road construction, but because we have come to lean so heavily on government relief funds, it's going to be a wrench."

In pleading for more federal funds other speakers referred to the fact that large areas in the West are federal-controlled (as high as 89 per cent of the area of Nevada), which presents a problem in highway financing unless the government cooperates to the greatest possible extent. R. E. Toms spoke of the function of a state highway department in the field of highway transportation. This paper will be abstracted in an early issue of *Engineering News-Record.*

Newly-elected officers of the association include: president, R. H. Baldock, Oregon; vice-president, Harry Hopkins, California; secretary-treasurer, K. C. Wright, Utah. The new executive committee includes James True, Wyoming; Chas. D. Vail, Colorado; J. H. Stemmer, Idaho; L. I. Hewes, Bureau of Public Roads, and Shelton Dowell, Arizona. Next year's meeting will be held at Denver, Colo.

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Historic Wooden Bridge Destroyed in Pennsylvania Flood

The historic old covered wooden bridge, built across the Raystown Branch of the Juniata River at Juniata Crossing, Pa., in 1818, was swept away by the recent flood of March 17-18. After 113 years of service the structure was retired in 1931 in favor of a graceful three-span concrete arch, and five years later came to an inglorious end by being dashed to pieces against its successor 300 ft. downstream. The old bridge was a link in the Chambersburg and Bedford Turnpike, now a part of the Lincoln Highway, built in 1815-20 as a toll road at a cost of $6,000 per mile. All records pertaining to the cost and construction of the bridge were lost in the burning of Chambersburg during the Civil War.

The wooden bridge was an elaborate structure in its day, consisting of two spans, each of three wooden trusses about 185 ft. long, carrying two roadways and a walkway. It was founded on two narrow stone abutments and a center stone pier. In 1889 the east abutment and the east span were damaged by ice and flood. This span was rebuilt with two trusses salvaged from the original structure, carrying a single 14-ft. roadway. This created one of the most unique bridges in the country—half its length a single roadway, and half a double roadway, with the transition from single to double width at mid-river. It is recorded that A. K. Bottomley, a contractor, received $1,700 and the timber remaining from reconstruction of the east span as his compensation for repairing the ice damage.

After completion of the new bridge, the old structure was left intact, though traffic was barred, at the instigation of the Pennsylvania Historical Society. The old stone tavern at the west end of the bridge, built in 1818 as a stage coach stop, is still in service.

The accompanying illustration and much of this information was obtained through the courtesy of Annie M. Gilchist, editor of the Bedford *Inquirer*.

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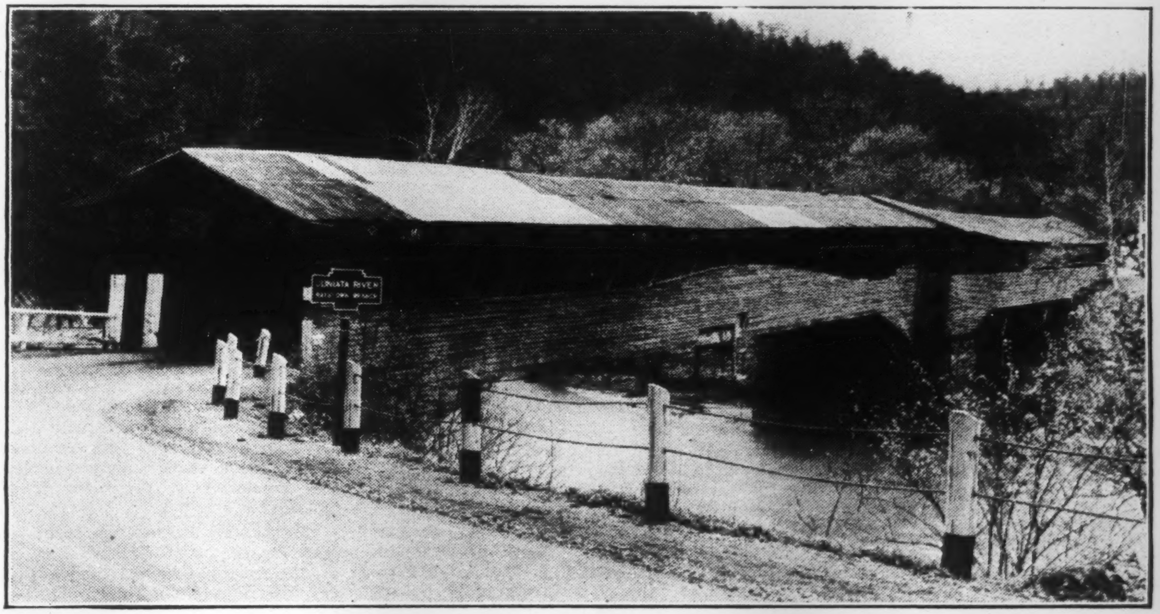
Broad Program Outlined For Waterworks Meeting

A comprehensive program covering many phases of the waterworks industry has been outlined for the annual meeting to be held in Los Angeles, Calif., June 8-12. Starting with the committee reports on Monday morning, which are to be followed by a main session, the program continues with technical sessions and conferences until Thursday evening. On Tuesday afternoon a main session, the plant management and operation division and a superintendents round-table discussion run concurrently with the water purification division and a directors meeting of the California Section. The following morning the water purification division continues its conference and the main session is continued. The Tuesday afternoon program is the same as that for the morning. On Wednesday morning there will be a main session concurrently with the finance and accounting division and subcommittee on standards of water quality conferences. These are to be followed by subcommittee meeting on specifications and tests for activated carbon and a committee meeting on short schools and licensing of waterworks employees. On Thursday morning there will be a joint session of the general membership and the water purification division, concurrently with a meeting of the finance and accounting division. In the afternoon the meeting of the plant management and operation division will be followed by a meeting of the board of directors.



Water Users Committee May Be Delayed

Appointment of a committee directed by Congress to investigate and recommend revision of construction repayment methods on reclamation projects may wait upon appointment of a new commissioner to succeed the late Dr. Elwood Mead. The investigation was provided for by the act approved by President Roosevelt on April 14, providing for extending the moratorium on payment of water users' obligations to the extent of suspending 50 per cent of construction payments for one year, with two per cent interest on the balance. The committee, to be composed of two representatives of the Department of Interior and one representative of the water users, will be appointed by Secretary Ickes.

SOCIETY CALENDAR

AMERICAN WATER WORKS ASSOCIATION, annual meeting, Los Angeles, Calif., June 8-12.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, semi-annual meeting, Dallas, Tex., June 15-20.

INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING, Cambridge, Mass., June 22-26, 1936.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, annual meeting, Madison, Wis., June 23-26.

HIGHWAY SAFETY CONFERENCE, Ames, Iowa, June 29-July 2.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, N. J., June 29 to July 3.

CANADIAN GOOD ROADS ASSOCIATION, annual meeting, Charlottetown, P.E.I., September 1-3.

THIRD WORLD POWER CONFERENCE, Washington, D. C., September 7-12.

PUBLIC WORKS CONGRESS, joint meeting, AMERICAN SOCIETY OF MUNICIPAL ENGINEERS AND INTERNATIONAL ASSOCIATION OF PUBLIC WORKS OFFICIALS, Toronto, Ont., September 28-30.

AMERICAN SOCIETY OF CIVIL ENGINEERS, regional meeting, Columbus, Ohio, May 15-16.

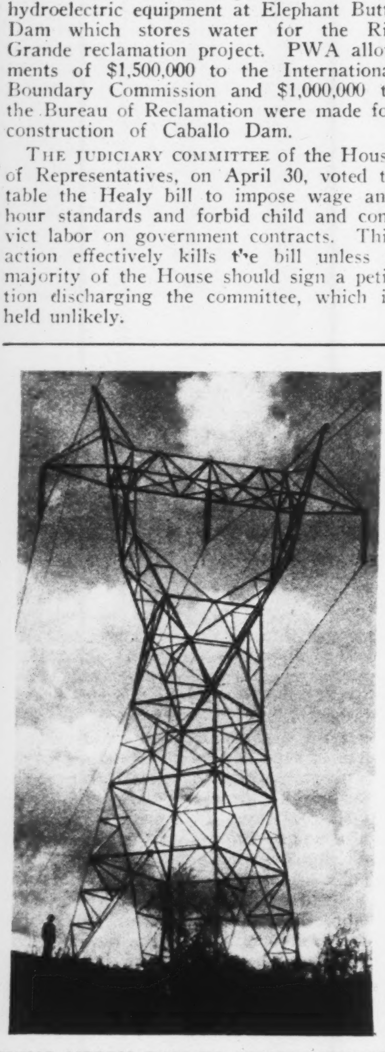
NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, New York City, May 23.

Brief News

DEVELOPMENTS IN CONSTRUCTION are presented in a survey, "The Construction Industry," made public on April 27 by the Commerce Department. The report combines an analytical discussion of the construction industry with a practical handbook or guide to the industry as represented by its leading trade associations. The study presents a running summary of trends in recent years for the various fields of construction. It also contains a summary of 1935-1936 projects and plans of the federal government in power and irrigation dam construction.

CONTRACT for the construction of Caballo Dam on the Rio Grande River near Hatch, N. M., has been awarded to Mittry Bros. Construction Co., Los Angeles, Calif., on a bid of $957,018. Caballo Dam is to be an earth dam 85 ft. high and 4,250 ft. long. The reservoir will have a capacity of 350,000 acre-ft. A tunnel 14 ft. in diameter and 560 ft. long will divert water during construction and upon completion of the dam will house the permanent diversion works. Caballo Dam is part of the International Boundary Commission's plan for rectification of the Rio Grande River and it will also provide an afterbay for the Elephant Butte Dam, making it possible to install hydroelectric equipment at Elephant Butte Dam which stores water for the Rio Grande reclamation project. PWA allotments of $1,500,000 to the International Boundary Commission and $1,000,000 to the Bureau of Reclamation were made for construction of Caballo Dam.

THE JUDICIARY COMMITTEE of the House of Representatives, on April 30, voted to table the Healy bill to impose wage and hour standards and forbid child and convict labor on government contracts. This action effectively kills the bill unless a majority of the House should sign a petition discharging the committee, which is held unlikely.



TYING NORRIS DAM TO MUSCLE SHOALS

Skylined above the west abutment of Norris Dam, this steel tower, the last to be erected, completes a 121-mi. section of the tie transmission line from Wilson Dam. The towers vary from 51 to 154 ft. in height and are built to carry three transmission conductors and two galvanized ground wires.

The tie line is being built in three sections. The first section is between the Wilson and Wheeler Dams, a distance of about 14.3 miles. Steel towers are also used on this section. At the Wheeler Dam the line crosses the Tennessee River and from there goes, via Ardmore, Ala., to a point about 4 mi. north of Monteagle, Tenn. This section is over comparatively level land and 4-pole wood construction has been used. From Monteagle, the third section of the line runs through the Cumberland Range on its way to Norris Dam.

Personals

GEORGES J. DESBARATS, former deputy minister of the Department of National Defense, Canada, has been elected an honorary member of the Engineering Institute of Canada. Mr. Desbarats, in 1879, became assistant engineer in the Department of Railways and Canals, and was later occupied in railway construction in British Columbia. In 1896, he reentered the government service, being in charge of a hydrographic survey on the St. Lawrence River in 1899.

ALEXANDER GRAY has been appointed by the Central Harbor Board of Canada as chief engineer and manager, and ALLAN G. MCAVITY, as assistant manager. Mr. Gray, in 1917, was appointed engineer in charge of St. John harbor, and continued at this post until 1927, when he was appointed chief engineer and general manager of the St. John Harbor Commission.

BLAKE R. VAN LEER, dean of the college of engineering, University of Florida, has been appointed as water consultant for the National Resources Committee in the southeastern section, embracing the states of South Carolina, Georgia, Alabama, Mississippi, and Florida.

SAMUEL B. MORRIS, formerly chief engineer and general manager of the Pasadena, Calif., water department, has been appointed as water consultant to the National Resources Commission. Mr. Morris, now head of the civil engineering department at Stanford University, is to report on a coordinated plan of water development of the Pacific Northwest drainage areas north of the California-Oregon line.

JOSEPH B. ESTABROOK, formerly with the Pillsbury Engineering Co., has become associated with Burlingame & Hitchcock, Inc., Minneapolis, Minn.

W. O. SNYDER has resigned as chief engineer of the Kentucky state highway department to accept a position with the Portland Cement Association. Mr. Snyder had been with the highway department for sixteen years, serving as chief engineer since 1933.

J. C. STEVENS, of Stevens & Koon, consulting engineers, Portland, Ore., has been appointed to the National Resources Board as water consultant in charge of the Colorado River Basin.

S. A. TREVARTHEN, staff engineer of the West Virginia state WPA, has been assigned to the Huntington (W. Va.) district office to take charge of the district engineering division following the recent resignation of Grover C. Christian.

H. A. SCHIRMER, resident engineer for the McClintic-Marshall Corp. has recently been appointed works engineer in charge of engineering for the fabricating works of the Bethlehem Steel Company at Alameda, Calif.

HERBERT R. KREBS, deputy county surveyor, was appointed Marion County resident engineer for the Ohio state highway department, succeeding George Hunt, who has been transferred to the office of Division Engineer F. W. Turner in Columbus.

Obituary

LEWIS M. HASTINGS, city engineer, Cambridge, Mass., from 1892 until his retirement in 1932, died at St. Petersburg, Fla., on April 25. Mr. Hastings, who was born in 1853, joined the Cambridge engineering department as a young man and under his administration as city engineer the Hobbs Brook water supply was developed and a number of rapid transit projects established.

CHARLES H. MOOREFIELD, federal district road engineer and former chief engineer of the South Carolina highway department, died in Columbia, S. C., on April

28. Dr. Moorefield was graduated in civil engineering from Virginia Polytechnic Institute in 1908 and for the next two years was an instructor in civil engineering at the same school. In 1910 he became highway engineer in the office of public roads, U. S. Department of Agriculture. He continued in this position until 1917 when he became an officer of the Civil Engineer Corps of the Navy and in 1920 he became state highway engineer in South Carolina. He continued in this position until 1935 when he became federal highway engineer at Spartansburg, S. C. He was also consultant on the Santee-Cooper project.

OSCAR DUFRESNE, contractor and financier of Montreal, Canada, died there on May 1 at the age of 60. The Dufresne Construction Co., handled the substructure of the Montreal Harbour Bridge and the Wellington Street subway in Montreal.

CHARLES A. L. KING, a retired civil engineer, died in Portland, Me., on May 3 at the age of 69. Mr. King had variously served as chief draftsman and assistant engineer for the Metropolitan Park Commission of Massachusetts, division engineer for the McKeesport & Connellsville Railroad and as engineer for various steel and coal companies in Pennsylvania.

JOHN H. CATON, 3d, chief of the division of roads and bridges, Rhode Island, died on May 2 in Providence, R. I. Maj. Caton, who was 54 years old, was also a member of the state planning board in 1934 and 1935. Maj. Caton, who had been regimental commander of the 33d Engineers during the war, later became assistant general manager of the Industrial Chemical Co., Providence, R. I., and was then appointed division engineer in the Bureau of Public Works, Las Vegas, Dominican Republic. Prior to the world war he was construction engineer in the Bureau of Public Works, Manila, P. I. In 1925 he joined R. W. Hebard & Co., Inc., engineers and contractors, New York City, to assume a position as assistant chief engineer on highway construction in Salvador, later assuming his last position.

JAMES ELLWOOD SMITH, well known advocate of waterway transportation and a past president of the Mississippi Valley Association, died in St. Louis, Mo., at the age of 85, on May 3.

CONSTRUCTION STATISTICS FOR THE WEEK

ENGINEERING construction at $39,467,000 is slightly higher for the week due to increased federal and private awards. This total is composed of private, $11,220,000; public, $28,247,000 of which federal is $3,259,000 and state and municipal $24,988,000. Corresponding values a year ago are: total, $17,460,000; private, $4,467,000; public, $12,993,000; federal, $3,054,000 and state and municipal, $9,939,000.

Highways, bridges and industrial and public buildings are responsible for this week's gain in volume. The classified totals are: public buildings, $8,129,000; commercial buildings, $4,995,000; industrial buildings, $5,131,000; highways, $11,319,000; bridges, $5,481,000; sewerage, $1,404,000; waterworks, $421,000; earthwork, drainage, $347,000; unclassified, $2,240,000.

The larger awards for the week include: extension to plant, first unit, Grand Rapids Varnish Co., Grand Rapids, Mich., $630,000; solvent extraction plant for Socony-Vacuum Oil Co., Olean, N. Y., $1,500,000; refinery improvements, Kendall Refining Co., Bradford, Pa., $1,200,000; superstructure Jane Addams housing project, Chicago, Ill., $1,335,000; highways, by California, $1,358,000; by Connecticut, $504,000; by Kansas, $760,000; by Minnesota, $851,000; by North Carolina, $979,000; esplanade and landscaping, East River Drive, Triborough bridge and between Legett Ave. and Hunts Point Road, New York City, $1,084,000; Contracts 2 and 3 for bridge over Lake Champlain, Lake Champlain Bridge Commission, New York, $422,000; bridges, by Kansas, $487,000; by Pennsylvania, $369,000; by New York, $418,000; sewers, day labor, Minneapolis, Minn., $790,000.

New capital for the week includes a transfer from federal to private investment financing through sale by RFC of $9,097,000 in PWA bonds. Bond sales for the week total $5,262,000 but this figure is reduced by $3,358,000 due to the Buffalo sewerage issue being put back into the market in a new offering because the original sale was not consummated. The net addition to new capital for the week is only $1,904,000.

CONTRACTS
(Thousands of Dollars)

	Weekly Average May 1935	Weekly Average Prev. 4 Weeks	Week May 7, 1936
Federal Government	$4,057	$1,238	$3,259
State and Municipal	12,172	23,195	24,988
Total public	$16,229	$24,433	$28,247
Total private ...	8,336	13,541	11,220
Week's total	$24,565	$37,974	$39,467

Cumulative to date:
1935...$460,084,000 1936...$835,668,000

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1936	Week May 7	Cumulative
State and municipal....	$11,001*	$189,082
PWA non-federal	—9,097*	40,547
RFC loans	....	37,008
Corporate issues	....	82,234
PWA loans, Private...	....	1,270
Total Non-Federal...	$1,904	$350,141
Federal	....	4,955
Total new capital....	$1,904	$355,096

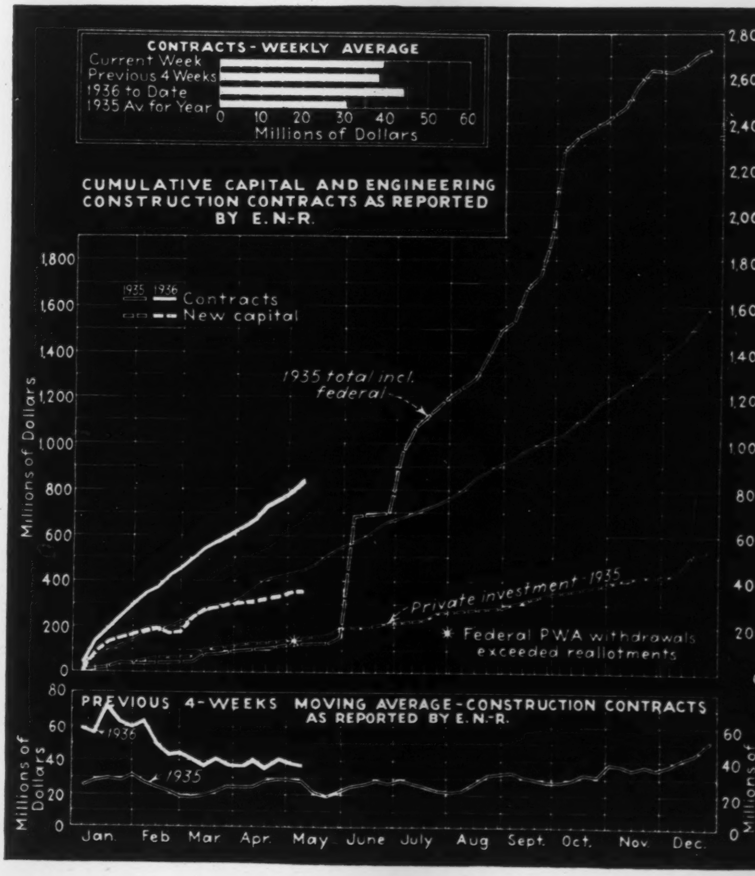
Cumulative to date:
1935...$127,290,000 1936...$355,096,000

*Includes transfer from PWA to private investment financing through sale by RFC of PWA bonds.

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for federal construction, deficiency act funds. An arbitrary percentage (25%) of the WPA allotments and local contributions to WPA work is included to allow for the capital additions through the Works Progress Administration division of the new program.

INDEX NUMBER

ENR Cost	**1913 = 100**	**1926 = 100**	**ENR Volume**	**1913 = 100**	**1926 = 100**
May, 1936...	**203.40**	**97.77**	**Apr., 1936...**	**166**	**73**
Apr., 1936...	202.20	96.71	Mar., 1936...	160	70
May, 1935...	194.06	93.28	Apr., 1935...	130	57
1935 (Av.)...	195.22	93.84	1935 (Av.)...	135	58
1934 (Av.)...	198.10	95.23	1934 (Av.)...	114	50
933 (Av.)...	170.18	81.80	1933 (Av.)...	102	47



BUSINESS SIDE OF CONSTRUCTION

April Construction Up 34 Per Cent Public Awards Gain 41 Per Cent

ENGINEERING construction awards for April total $195,458,000 for a 5-week month, a gain of 34 per cent over the rate at which heavy construction went under contract in April, 1935. Federal awards dropped to a new low, the lowest weekly rate since August, 1933, while state and municipal awards gained 19 per cent over last month and 79 per cent over last April. Private awards are 14 per cent below last month but gained 20 per cent over last April. The totals for the month are made up of: private, $63,703,000; public, $131,755,000; federal, $6,929,000. Corresponding values a year ago are (for a 4-week month): total, $116,972,000; private, $42,439,000; public, $74,533,000; federal, $18,646,000.

Both highway awards and public buildings contribute to the gain in public construction. Highway awards rose to $52,704,000 for the month and public buildings to $31,754,000. Industrial buildings rose to $34,165,000 and commercial buildings to $20,074,000. For public and commercial buildings the gain over last April is small but the gain for the first four months over the same period last year is 122 per cent for public, and 92 per cent for commercial buildings. The gain for the year to date in industrial buildings is 121 per cent over the first four months of last year.

April awards remained above last April in all territories except Far West which failed to equal the high volume recorded last year. Far West reports a gain over last month and is the only territory, except Middle Atlantic that shows a higher volume of construction in April than in March. Middle Atlantic registers the highest volume of construction for any month in more than three years.

New Capital

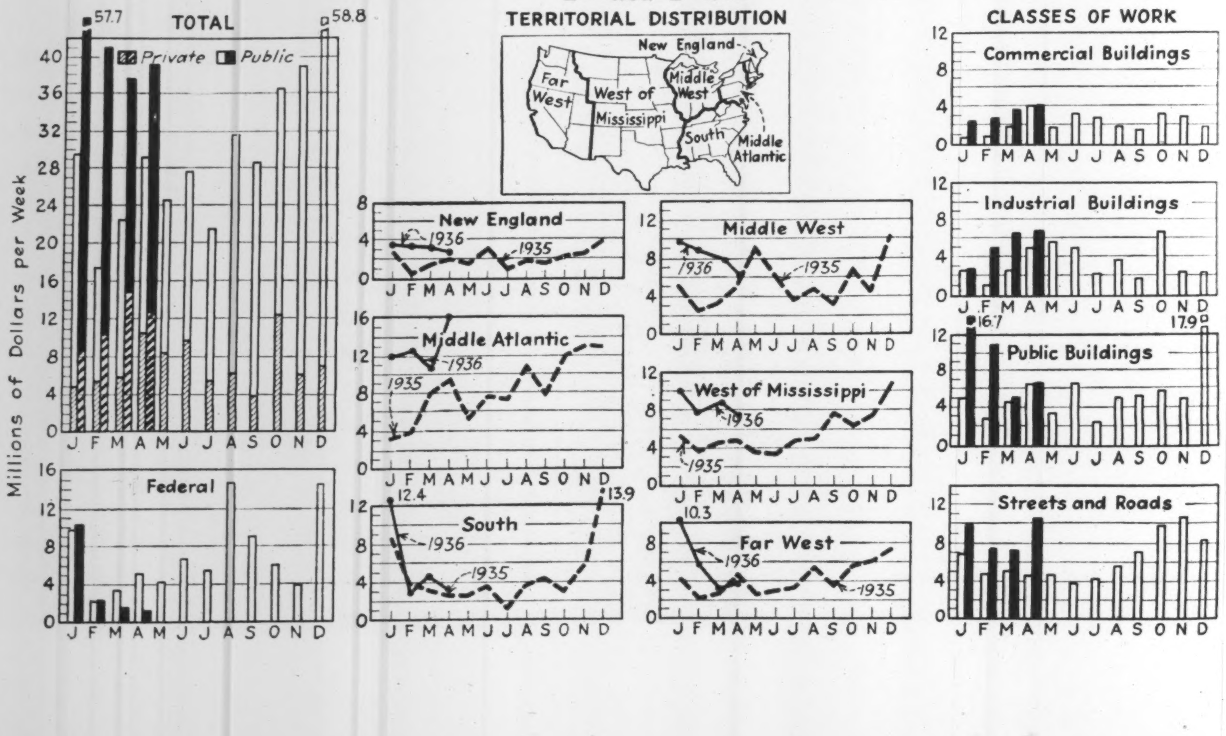
New capital in April consisted almost entirely of private investment financing through state and municipal bond sales and sales of corporate securities issues. The exceptions consisted of RFC purchases of bonds of Metropolitan Water District, Los Angeles, $11,808,000 and of irrigation bonds for new construction.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN APRIL, 1936

Five Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States April 1936	United States Four Months 1936	United States Four Months 1935	Canada April 1936
Public Works										
Waterworks	891	1.915	1.917	1.823	1,230	1,973	**9,749**	46.485	24,837	295
Sewerage	1,490	2.240	981	3.454	1,962	187	**10,314**	56.905	18.760	154
Bridges, public	1.098	3,196	1.404	1,193	4.181	361	**11,433**	54.295	23.159	..
Earthwork and waterways	136	2.379	1.314	119	1.341	1.227	**6,516**	59,488	61,411	65
Streets and roads	5.460	8,927	5.041	14.165	14.830	4,281	**52,704**	160,486	90.523	543
Buildings, public	3.098	11.010	2.743	5.627	6.323	2,953	**31,754**	176.242	80.308	157
Unclassified, public	518	4.536	402	484	1,041	2.304	**9,285**	36.285	16,798	146
Total public	12.691	34.203	13.802	26.865	30,908	13.286	**131,755**	590.186	315,796	1,360
Federal gov't (included in above classifications)	308	1.533	1.326	507	1,441	1,814	**6,929**	76,303	89,840	.....
Private										
Bridges, private	150	......	......	46	292	1.500	**1,988**	3,497	4,937	..
Buildings, industrial	755	27,875	1.079	1,696	1,532	1,228	**34,165**	91,771	43,802	8,561
Buildings, commercial	280	16.378	......	1,032	1,837	547	**20,074**	57,327	29,937	640
Unclassified, private	100	1.752	520	1,401	1,165	2.538	**7,476**	53.420	29,811	
Total private	1.285	46.005	1.599	4.175	4.826	5.813	**63,703**	206.015	108.487	9,201
April, 1936 (5 weeks)	**13,976**	**80,208**	**15,401**	**31,040**	**35,734**	**19,099**	**195,458**	......	......	**10,561**
March, 1936 (4 weeks)	12.304	41.277	17.833	31,036	34,360	10.887	**147,697**	......	......	5,387
April, 1935 (4 weeks)	7.513	37.066	10.864	20,561	19,180	21.788	**116,972**	......	......	1,185
Four months, 1936	56,269	231.527	105.773	145,476	151,400	104,756	......	796.201	......	31,267
Four months, 1935	27.857	103.016	81,822	68,516	79,556	63,516	......	......	424,283	15,979

ENGINEERING CONSTRUCTION REPORTED BY E.N.-R. WEEKLY AVERAGES

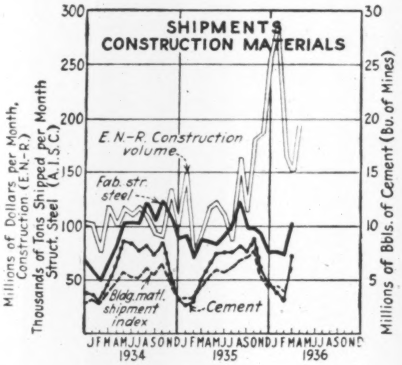


$200,000. Total additions to new capital for the month aggregated $53,000,000.

Materials

Cement—The Portland cement industry in March, 1936, produced 5,263,000 bbl., shipped 7,138,000 bbl. from the mills, and had in stock at the end of the month 21,096,000 bbl. Production showed an increase of 22.4 per cent and shipments an increase of 46.3 per cent over March, 1935, while stocks at mills were 0.9 per cent lower than a year ago, according to reports received by the Bureau of Mines. The ratio of production to capacity was 23.4 for March compared with 18.9 last March and 16.4 in February, 1936.

Steel—The operating rate of steel companies having 98 per cent of the steel capacity of the industry and reporting to the American Iron and Steel Institute rose from 62.0 in the week beginning March 30 to 71.2 for the week beginning April 27. The average operating rate for April was 67.2 compared with 44.0 a year ago.



Bookings of structural steel in March, reported by the American Institute of Steel Construction, declined from the first two months of the year. However, the monthly average for the first quarter of 1935 held up to 51.5 per cent of normal—the annual average of shipped tonnages as published by the U. S. Department of Commerce, for the years 1928-31 inclusive, and is ahead of the volume booked for a similar period in any of the previous four years. March shipments showed an increase over the previous two months to 43.8 per cent of normal.

Lumber—Lumber production averaged during April 61 per cent of the 1929 weekly average of production, and shipments in April averaged 67 per cent of the 1929 weekly shipments. Reported production and shipments for the week ending April 18 were higher than any previous week of this year, according to reports to the National Lumber Manufacturers Association. Shipments for the week ending April 18 were reported in excess of 228,000,000 ft.

The index of shipments of construction materials reported by Advance Construction Programs Unit, Space Control, is 61 for March compared with 43 for March a year ago and 40 for February this year, an increase from 34 reported for February, 1935.

Building Permits

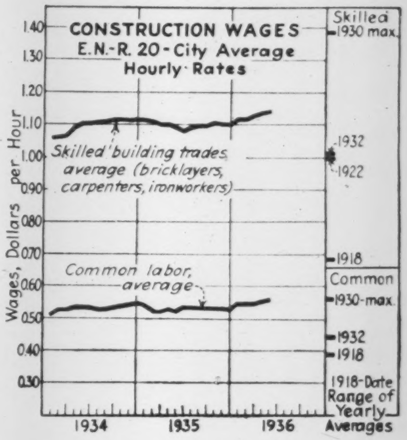
The largest March figure for building permits reported to Dun & Bradstreet, Inc., since 1931 is $78,120,344. Compared with the February permit value of $51,559,661, a rise of 51.5 per cent is shown, while the increase over the March, 1935, figure of $45,063,852 amounts to 73.4 per cent. The gain in New York City over March, 1935, is 28.2 per cent while the gain outside New York City is 88.7 per cent. The gain for the first quarter over last year is 85.5 per cent, 70.4 for New York City and 90.1 outside of New York City.

Labor

Employment in the production of six major construction materials as reported by Advance Construction Programs Unit, Space Control, is 46.4 for March, 1936, compared with 40.0 a year ago and 44.1 last month. The February value of this index, 44.1, compares with 38.7 for February, 1935. This index is based on 1923-25 equals 100.

Private building construction employment in March, as reported by the U. S. Bureau of Labor Statistics, increased 28.9 per cent in employment and 36.9 per cent in payrolls over February according to reports from 8,893 contractors employing 71,513 workers engaged in the erecting, altering and repairing of private buildings. This heavy percentage gain is due in considerable part to the low February activity due to sub-zero weather.

Approximately 3,400,000 workers were employed during the month ending March 15 on the program financed from the Emergency Relief Act of 1935. This is a gain of approximately 150,000 compared with February. Over 3,000,000 of these workers were on WPA projects. The PWA program employed 210,000; CCC had 301,000 enrolled workers.



The St. Louis strike of 2,000 union building mechanics and laborers employed on 22 Public Works Administration projects was ended April 2, due largely to the agreement of Mayor Dickmann to inform WPA officials that the City of St. Louis will not start future WPA projects that involve skilled labor until settlement of present differences. It is reported that WPA projects have been paying skilled workers from 55 to 84 cents per hour, while the union scale is from $1.25 to $1.50 per hour.

Minneapolis, formerly an open-shop city, has seen a gradual change in the labor setup and the adoption of union wage scales. Bricklayers will get $1.25 in Minneapolis and $1.10 in St. Paul; ironworkers, $1.20; reinforced ironworkers, $1.00; carpenters, $1.00. Further changes are forecast during the next month or two.

Buildings trades workers employed on Cleveland's three slum clearance projects returned to work April 30 after a shutdown of almost 2 months. Skilled and unskilled workers on the Outhwaite and West Side projects are to receive the prevailing rate of pay, which means an additional $1 a day to the skilled workers and an increase to 80 cents an hour for unskilled.

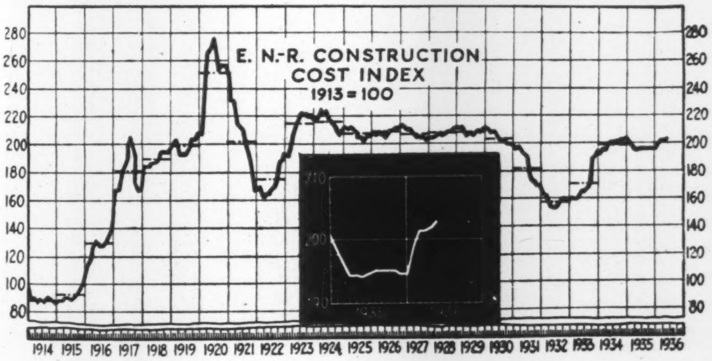
ENR Cost and Volume Index

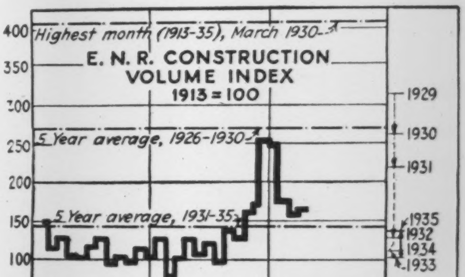
THE *Engineering News-Record* Construction Cost Index is 203.40 for May. The increase is due to an increase in the common labor wage average.

The *ENR* Volume Index is 166 for April.

INDEX NUMBER

ENR Cost	**1913 = 100**	**1926 = 100**	**ENR Volume**	**1913 = 100**	**1926 = 100**
May, 1936	**203.40**	**97.77**	**Apr., 1936**	**166**	**73**
Apr., 1936	202.20	96.71	Mar., 1936	160	70
May, 1935	194.06	93.28	Apr., 1935	130	57
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50
1933 (Av.)	170.18	81.80	1933 (Av.)	102	47





CURRENT PRICES OF CONSTRUCTION MATERIALS

CEMENT, AGGREGATES AND READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT Per bbl., carload lots, including 40c. per bbl. for bags, cash discount not included			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE Ready M 1:2:4, 50c more, deliv
	Cloth Bags*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.83	$2.58	$2.50	$2.31	$2.31	$1.55	$1.69	$1.92	$1.69	$1.69	$8.50
Baltimore	2.65	2.40	2.15	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.80	1.80	7.25
Birmingham	2.40	2.15	1.95	1.80	1.80	1.45	1.00	1.00	.90	1.15	5.45
Boston	2.42	2.17	1.92	1.40	1.40	.90	1.40	1.40	.....	.....	6.50
Chicago	2.60	2.35	2.20	1.50	1.50	1.44	1.80	1.80	1.10	1.10	.....
Cincinnati	2.51	2.25	2.05	1.20	1.20	1.30	1.80	1.80	.....	.....	6.70
Cleveland	2.41	2.16	.....	1.40	1.40	1.30	1.60	1.60	1.75	1.75	7.15
Dallas	2.45	2.20	2.00	1.55	1.55	1.30	1.95	2.05	.....	.....	7.00
Denver	3.09	2.84	.....	1.20	1.40	.90	.....	.....	.....	.....	.....
Detroit	2.26	2.01	1.81	1.15	1.15	.85	1.30	1.40	1.35‡	1.45‡	5.95
Kansas City	2.51	2.26	2.06	.....	1.85	1.25	1.85	1.80	.....	.....	7.65
Los Angeles	2.32	2.12	.....	1.20	1.20	.90	1.20	1.20	.....	.....	6.31
Minneapolis	2.90	.....	2.45	1.00[p]	1.00[p]	.25[p]	1.00[p]	1.00[p]	.....	.....	6.75
Montreal	.....	1.70	.....	.85	.90	1.25	.85	1.20	.....	.....	4.50
New Orleans	2.47	2.22	2.00	1.50	1.50	1.25	.....	.....	.....	.....	8.25
New York	2.60‡	2.35‡	.....	1.20†[k]	1.20†[k]	.70†[k]	1.75†[k]	1.85†[k]	.....	.....	8.00
Philadelphia	2.68	2.43	2.23	1.45‡	1.55‡	1.15‡	2.60‡	2.75‡	1.00‡	1.00‡	8.00
Pittsburgh	2.46	2.21	1.61	1.50‡	1.50‡	1.70‡	2.25‡	2.25‡	1.50	1.50	7.00
St. Louis	2.53	2.28	.....	1.40‡	1.40‡	1.40‡	.75[p]	.75[p]	.65/.95§	.50/.95§	6.80
San Francisco	2.72	2.52	2.20	1.35	1.35	1.35	1.50	1.50	.....	.....	7.53
Seattle	2.95	2.70	.....	1.00	1.00	1.00	1.44	1.44	.....	.....	6.75

*10c. allowed for each returnable bag. †Per cu. yd. ‡Delivered. §F.o.b. Granite City, Ill. [k]Barge lots alongside dock. [p]f.o.b. plant. [t]5 tons or more. [s]Within 3-mi. from Pub. Square. [t]ton. d 25c. discount for cash.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Alpena, Mich	$1.50	$1.45	Ironton, Chio	$1.50	$1.45	North Birmingham, Ala	$1.75	$1.70
Buffington, Ind	1.70	1.65	Iola, Kans	1.70	1.65	Richard City, Tenn	1.85	1.80
Crestmore, Calif	1.72	....	La Salle, Ill	1.70	1.65	Saginaw, Mich	1.50	1.45
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	Limedale, Ind	1.70	1.65	Steelton, Minn	1.80	1.75
Hannibal, Mo	1.70	1.65	Mason City, Ia	1.70	1.65	Universal, Pa	1.65	1.60
Hudson, N. Y	1.75	1.70	Norfolk, Va	1.76	1.71	Waco, Tex. (Plus 5c. Tax in Texas)	1.75	1.70
Independence, Kans	1.70	1.65	Northampton, Pa	1.65	1.60	Wyandotte, Mich	1.45	1.40

Cash Discounts, Cement, to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount, 10c. per bbl. for payment within 15 days of date of invoice.

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M, lots of 2,000 pieces or over,			STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M, lots of 2,000 pieces or over,			BRICK Per M, in quantity,		LIME Per ton, in paper, carload lot		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverize or lump
Atlanta	$71.10	$75.80	$142.10	$170.50	$199.00	$227.40	$12.00	$14.25	$18.50	$13.00	$13.00
Baltimore	91.00	98.00	183.00	219.00	315.00	390.00	13.00	17.00	16.00	12.50	18.50
Birmingham	78.75	84.00	157.50	189.00	201.25	242.00	15.00	19.00	2.50§	1.50§	2.00§[e]
Boston	84.40ι	90.00ι	168.75ι	191.25ι	246.75ι	282.00,	14.50	18.00	19.00	14.75	3.30[e]
Chicago	66.00	70.40	132.00	174.30	214.40	245.00	10.20	11.20	18.00	13.40	14.00
Cincinnati	55.00	58.70	110.00	124.10	164.20	187.70	17.50	17.50	15.97	12.48	.....
Cleveland	45.00	48.00	90.00	108.00	138.50	158.50	15.00	15.00	16.00k	14.00k	2.65k[p]
Dallas	72.00	75.00	149.00	177.00	217.00	269.00	13.50	26.00	19.00	16.00	1.65[p]
Denver	78.50	88.00	141.50	166.50	196.00	225.00	11.50	15.00	30.00	22.00	22.50
Detroit	71.85	76.65	143.70	230.00	280.00	325.00	12.50	13.50	14.25	11.90	22.20
Kansas City	72.50	75.50	92.00*	140.50	177.75	207.25	15.00	24.00	18.00	12.40	14.20[e]
Los Angeles	77.50	94.25	134.00*	188.00	232.50	311.50	11.50	14.00	18.70	.....	19.70
Minneapolis	80.15s	85.50s	145.40s	167.75s	175.25s	243.70s	13.10	15.10x	25.50	21.00	23.00
Montreal	79.10s	90.40	169.50s	......	212.40	136.60	20.75	31.00	15.00	10.00	7.00
New Orleans	69.10	69.10	129.50	155.40	203.40	251.80	14.00	.....	18.90	11.35	.....
New York	78.40	83.60	125.40*	193.30†	238.80†	295.60†	11.50	.....	20.00	15.50	20.00
Philadelphia	86.00	90.00	150.00	200.00	240.00	280.00	18.00	20.00	16.35	11.25	10.75
Pittsburgh	58.40c	62.30c	116.85c	165.00c	217.00c	250.00c	16.50	25.00	17.20	14.50	2.22[p]
St. Louis	62.00	65.00	120.00	180.00	234.00	280.00	15.00	18.00	22.00	16.00	2.25[p]
San Francisco	64.00	94.50	225.00	......	......	......	15.00	18.00	22.11	21.50	2.05[p]
Seattle	84.00	95.50	180.00	198.00	......	......	15.50[d]	18.50	30.00	20.00	28.60[p]

*6x12x12 in. †F.o.b. Perth Amboy, N. J. ‡Per sack. §Per bbl., 200 lbs. [p]Per bbl. 180 lbs. [q]per bbl. 280-lb. kLCL. [d]less $1 cash 15 days. [e]lump. sSmooth. xSelected common. ιCarload lots delivered to job.

ROAD SURFACING MATERIALS—F.O.B. CITY

	PAVING BRICK AND BLOCKS			PAVING ASPHALT Per ton, less than 80 penetration,		ASPHALT BINDERS—FLUXES Per gal., 80-300 penetration,		CUTBACK ASPHALT Per ton,		ROAD OILS Per gal.,	ASPHALT EMULSION Per gal.,	
	Granite per M, lots of 50,000, 4x4x8 in.,	Brick per M, 3x4x8½ in., carload lots	Wood per sq. yd., 3½ in., 16-lb. treat,	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drum
Atlanta	$75.00	$35.00	$2.25	$18.20[2]	$23.41[2]	$0.728[2]	$0.999[2]	$19.20[2]	$27.22[2]	$0.668[2]	$0.0875	$0.0875
Baltimore	110.00	44.00	2.25	17.00	22.00	.075	.10	.09†	.125†	.....	.....	.....
Birmingham	110.00	25.00	....	19.00	24.00	.0878	.1128	.10†	.137†	.....	.06	.....
Boston	78.00	26.00	2.75	17.00	22.00	.07	.095	.09†	.12†	.07	.095	.125
Chicago	125.00	42.00	2.60	16.00	20.00	15.00	19.00	.07	.11	.05	.....	.....
Cincinnati	115.00	37.00	....	13.47	17.47	.12	.....	17.00	.....	.055	.08	.....
Cleveland	100.00‡	32.75	2.85	17.00	21.00	.07	.08	.075†	.045†	.0525	.085	.095
Dallas	.....	30.00	....	16.50	21.00	.065	.16	17.50	25.00	.055	.10	.105
Detroit	.....	37.00	....	16.80[k]	21.00[k]	.....	.....	15.25	20.25	.055	.11	.15
Kansas City	.....	45.00	....	18.50	23.50	17.50#	22.50#	.077†	.107†	.057	.11	.15
Los Angeles	.....	50.00	....	10.34	14.50	10.34#	14.50#	10.34	.....	.042	.06	.12
Minneapolis	.....	.....	1.75l	18.20	24.70	.098	.098	21.85	34.65	.048	.....	.....
Montreal	70.00	60.00	3.62	14.00	19.66	.07	.093	19.00	26.50	.07	.135	.165
New Orleans	100.00	32.00	....	15.00	18.75	.068	.095	.075†	.10†	.....	.0785	.11
New York	130.00§	65.00	2.64	17.00	22.00	.075	.10	.09†	.125†	.....	.075	.11
Philadelphia	110.00	45.00	2.25	13.50	18.00	.05	.08	.05†	.08†	.045	.08	.....
Pittsburgh	115.00	40.00	....	19.00	24.00	.0775	.1125	.086†	.121†	.0675	.....	.....
St. Louis	40/115.00	35.00	....	19.70	24.70	.0775	.1075	.0825†	.1125†	.045	.09	.125
San Francisco	.....	50.00	....	12.00	18.00	12.00#	18.00#	12.50#	23.00#	.04	.0575	.117
Sattle	.....	35.00	....	25.50	25.50	17.00#	23.00#	15.00	.....	.03	.19	.20

Note: Paving asphalt, tank car or boat, f.o.b. Maurer, N. J., per ton, Bermudez, $25.00; Trinidad, $21.00. *Per sq. yd. †Per gallon. ‡4½x6x5½ in. #Per ton §4x5x9-in. Av. [k]Mexican. [2]Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. l 2½ in. 6 to 8-lb. treatment.

CURRENT PRICES OF CONSTRUCTION MATERIALS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in. billet,	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle bars	Std. spikes	Tie plates	Track bolts
Birmingham	$1.95	$2.10	$3.00	$2.55	.....	$36.375	$36.37	$35.00	$2.55	$2.60	$1.90	$3.60
Chicago	1.85	2.10	3.00	.....	$2.25	36.375	35.00	34.00	2.55	2.60	1.90	3.60
Pittsburgh	1.80	2.05	2.90	2.10	2.15	36.375	35.00	34.00	2.55	2.60	1.90	3.60

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

F.O.B. WAREHOUSE	STRUCTURAL SHAPES Per 100 lb., base price	REINFORCING BARS Per 100 lb., ¾ in., base price New billet	Rail steel	EXPANDED METAL LATH —Per 100 sq.yd., carload lots— Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING —Per 100 s.f., carload lots— 4x16 in., No. 5 & 10 wires	4x12 in., No 8 & 12 wires	6x6 in., No 6 & 6 wires Per sq yd.	SHEET PILING Per 100 lb. base price
Atlanta	$3.36	$2.34	$2.19	$21.00	$23.00	$1.53	$1.16	$0.1449	$2.70
Baltimore	3.00	2.75	2.60	25.00	28.00	1.41	1.08	.1332	2.45
Boston	3.54	2.923	1.925	19.50†	21.50†	1.46	1.12	.1449	2.60
Chicago	3.20	2.10	1.95	22.00	24.00	1.40	1.08	.1323	2.25
Cincinnati	3.40	3.25	3.25	25.01	29.50	1.39	1.07	.1287	.....
Cleveland	3.31	2.75	2.60	20.00	22.00	1.37	1.06	.1287	
Dallas	3.82	3.05	2.90	21.00	28.00	1.63	1.23	.1548	3.005
Denver	3.95	3.76	3.61	22.00	25.00	1.68	1.26	.1584	.
Detroit	3.42	2.20	2.05	20.00†	22.00†	1.41	1.08	.1323	2.43
Kansas City	3.75	2.75	2.60	15.50	19.50	1.50	1.14	.1422	2.69
Los Angeles	2.35	2.325	....	23.00	27.50	1.68	1.26	.1584	2.65
Minneapolis	3.45	2.86	2.71	22.00	26.00	1.51	1.15	.1431	2.57§
Montreal	2.90	2.40	2.30	32.00	33.00	2.30	1.71	.238	2.80
New Orleans	...		....	21.00	24.00	1.54	1.17	.1458	
New York	.37	2.50	2.35	19.50	21.50	1.44	1.11	.1359	2.50
Philadelphia	2.98	3.06	2.22	20.00	24.00	1.42	1.09	.1332	2.46
Pittsburgh	1.80‡	1.85‡	1.70‡	20.00‡	22.00‡	1.34	1.04	.1260	2.15
St. Louis	3.45	2.45	2.30	22.00	24.00	1.42	1.09	.1341	2.30
San Francisco	3.15	2.475	2.325	23.00	28.00	1.68	1.26	.1584	2.60
Seattle	3.55	2.50	....	24.50	26.50	1.68	1.26	.1584	2.60

‡Base Mill Price. Note: Shapes, bars and piling subject to quantity discounts. §Mill Price plus freight to Minneapolis. †f.o.b. delivered.

PAINTING AND ROOFING SUPPLIES—F.O.B.

	RED LEAD Per 100 lb. in 500-lb. lots Dry	WHITE LEAD Per 100 lb. in 500-lb. lots# in oil	READY-MIXED PAINT Per gal., drums Graphite*	Aluminum†	Ferric Oxide‡	ROOFING SUPPLIES Carload lots, f.o.b. factory Rolls, slate surfaced, 85-90 lb., per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating, per gal.	Tar pitch, 350-lb. bbl., per ton
Atlanta	$7.75	$11.50	$1.60	$3.10	....	$1.95	$1.95	$1.95	$.38	$28.00
Baltimore	7.00	10.50	1.40	2.25	$1.90	2.35	2.55	2.55	.48	25.00
Birmingham	7.25	11.00	2.35	2.35	1.85	2.01	1.77	1.77	.36	22.00
Boston	7.00	10.50	1.85	2.70	.05x	1.75	3.15	3.15	.43	22.00
Chicago	7.00	10.50	1.35	2.45	1.30	1.55	2.50	2.50	.38	22.00
Cincinnati	7.00	10.50	1.45	2.50	1.40	2.40	2.39κ	2.39κ	.36	21.00
Cleveland	7.00	10.50	1.65	2.30	1.40	1.55	1.75κ	1.75κ	.23	19.00
Dallas	7.25	11.50	1.80	2.10	....	2.35κ	3.80	3.80	.14	35.00
Denver	7.50	11.25	2.55	....	....	2.75	3.55	3.55	.35	30.00
Detroit	7.00	10.50	1.65	2.30	1.40	2.55	2.80	2.55	.35	30.00
Kansas City	7.00	10.62½	1.25	2.65	1.00	2.05	3.10–3.20	3.10–3.20	.25	24.50
Los Angeles	7.25	10.75	1.60	2.25	2.30	2.00	1.50	....	.45	....
Minneapolis	7.00	10.62½	....	....	....	1.78v	1.52κv	1.52κv	.29	23.30
Montreal	....	8.20	1.85	3.50	1.85	1.90	2.44	1.88	1.55§	1.52x
New York	7.00	10.50	1.75	2.35	1.40	1.75	1.61κ	1.61κ	.23	22.00
Philadelphia	7.00	10.50	2.50	2.95	1.50	1.68	1.85κ	1.48κ	.37	22.00
Pittsburgh	7.00	10.50	1.05	1.95	.80	1.75	1.65κ	1.65	.38	25.00
St. Louis	10.00	10.50	1.85	2.45	1.30	1.73κ	2.46	2.46	.24	25.00
San Francisco	7.25	10.75	1.80	2.75	1.10–2.00	1.89	3.10	3.10	.38	26.00
Seattle	7.25	10.75	1.80	2.85	2.20	3.30	2.66	2.60	.60	30.00

*U. S. War Dept. Spec. 3-49A. †ASTM Spec. D266-31. ‡80% maximum ferric oxide. §Per 100 lb. κPer roll, 65 lb. xPer lb. v Minneapolis & vicinity
Note: Red lead in oil 50c higher than white lead in oil. #Basis of quoting changed this month from list to 500-lb. lots.

MISCELLANEOUS ITEMS

	WINDOW GLASS Discounts from latest jobbers List, Sept. 15, 1928 Single or Double Thickness A quality	B quality	EXPLOSIVES Per lb. dynamite delivered 50-lb. cases Gelatin 40%	60%
Atlanta	85%	85%	$0.155	$0.17
Baltimore	88%	90%	.16	.175
Birmingham	88%	90%	.105	.120
Boston	88–10–5%	90–10–5%	.165	.185
Chicago	87%	89%	.155	.17
Cincinnati	89–10%	91–10%	.27	.29
Cleveland	89%	89%	.20	.215
Dallas	87%	89%	.1675	.1825
Denver	86%	88%	.155	.17
Detroit	87–10%	89–10%	.225	.240
Kansas City	86–10%	87–10%	.16	.175
Los Angeles	90%*	90–40%	.1725†	.1925†
Minneapolis	86%	88%	.175	.19
Montreal	60–30%	70–5%	.1875	.2125
New Orleans	88%	90%	.19	.22
New York	89%	90%	.225	.24
Philadelphia	88%	90%	.1550	.17
Pittsburgh	88%	88%	.11	.1250
St. Louis	89%	89%	.11	.125
San Francisco	80%	85%	.1575	.1775
Seattle	90–10%	90–20%	.1425	.1575

*Disc. from list Aug. 1, 1929. †F.o.b. Arsenal. ‡Double thickness A & B.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York.

Bleaching powder, in drums, F.o.b. works, per 100 lb.	$2.00–$2.25
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competition, per ton	22.00–35.00
Chlorine cylinders, per lb. delivered	.055
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in paper bags, per 100 lb. dense	1.25
Sulphate of aluminum, commercial, in 100 lb. bags per ton	27.00
Sulphate of copper, in bbl., per 100 lb.	4.00

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf Barge	Short Leaf Rail	Long Leaf Barge	Long Leaf Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.12	$0.165	$0.13	$0.16
12 in.—2 ft. from butt.	6 in.	50 to 59 ft.	.16	.21	.15	.20
12 in.—2 ft. from butt.	6 in.	60 to 69 ft.	.17	.225	.16	.21½
14 in.—2 ft. from butt.	6 in.	50 to 69 ft.	.195	.235	.20½	.24½
14 in.—2 ft. from butt.	6 in.	70 to 79 ft.	.2125	.245	.24½	.30½
14 in.—2 ft. from butt.	5 in.	80 to 85 ft.	.275	.385	.....	.....
14 in.—2 ft. from butt.	5 in.	85 to 89 ft.	.315	.452	.....	.....

RAILWAY TIES

Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Boston	Oak, untreated	$1.25	$1.80
	Pine, untreated	1.35	1.85
	Pine, creosoted	1.75	2.45
New York	Long-leaf sap pine, untreated	.80	1.00
	Mixed oak, untreated	....	1.10
Birmingham	White oak, untreated	.75	1.25
	Red oak, creosoted	1.40	1.60
	Southern pine, untreated *6x8x8′6′	.45*	.60
	Southern pine, creosoted	1.00*	1.25
Chicago	White oak, untreated	1.15	1.40
	Oak, empty cell, creosoted	1.50	1.88
	Oak, zinc treated	1.40	1.70
	Southern pine, creosoted	1.35	1.78
Los Angeles	Fir, untreated	.50	.72
	Fir, creosoted	1.67	2.40
Philadelphia	Red oak, untreated	1.00	.....
	Red oak, creosoted	....	2.10
St. Louis	White oak, untreated	1.13	1.45
	Red oak, untreated	1.10	1.40
	Red oak, creosoted	1.50	1.95
	Sap Pine or cypress, untreated	.95	1.30
San Francisco	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.10
	Birch or maple, creosoted	1.25	1.55

CURRENT PRICES OF CONSTRUCTION MATERIALS

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE	VITRIFIED SEWER PIPE				CLAY DRAIN TILE		CONCRETE SEWER PIPE		WROUGHT STEEL PIPE Full standard weight. #			
	Per net ton, f.o.b. 6 in. to 24 in.*	Per foot, delivered, ASTM C 13-35 8 in., s.s.	12 in., s.s.	24 in., d.s.	36 in., d.s.	Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	Per ft., delivered; ASTM C 14-35 12 in.	24 in.	1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap W Black %	Galv %
Atlanta	$43.00	$0.225d	$0.405d	$1.4625	$4.50	$80.00	$128.00	$0.50	$1.625	49.5	40.5	47	37.5
Baltimore	46.50	.25	.50	2.10	5.75	108.00	168.50	.75	2.00	....	....	....	....
Birmingham	39.00	.25	.45	1.625	4.66	85.00	220.00	.45	1.60	69.5	61.5	67	58.5
Boston	46.50	.21	.405	1.89	5.6375	99.00	153.00	.40	2.35	....	....	....	....
Chicago	47.50	.21	.35	1.60	4.60	60.00	120.00	.36	1.42	53	42	54	43
Cincinnati	46.00	.189	.3645	1.62	5.535	69.00	108.00	.40	1.40	58.75	48.75	55.625	45.0
Cleveland	47.50	.182	.351	1.62	4.8175	42.50	88.50	.35	1.74	61	51	57.9	47.2
Dallas	51.00	.35	.67	2.70	.....	165.00	260.00	.46	1.57	64	55	64	56
Denver	59.00	.27‡	.47‡	1.98‡	.....	105.00	180.00	.....	.....	....	....	....	....
Detroit	47.50	.189	.3645	1.62	5.74	82.00	136.00	.35	1.20	....	....	....	....
Kansas City	49.00	.30	.54	2.16	4.90	120.00	140.00	.40	1.50	55	45	51.5	41
Los Angeles	47.50	.2825‡	.508‡	2.03‡	5.535‡	115.50	192.50	1.00	2.00	62.1	54.1	59.6	51.1
Minneapolis	49.50	.24‡	.432‡	1.728‡	4.60‡	.....	......	.65	1.65	....	....	....	....
Montreal	50.00	.33t‡	.59t‡	2.04t‡	.....	82.00	134.00	.51	2.048	....	....	....	....
New Orleans	45.00	.25	.45	1.625	.....	67.00	......	.45	1.65	....	....	....	....
New York	46.00	.28	.55	2.35	6.35	.....	......	.55	2.00	57.50[s]	47.50[s]	54.375[s]	43.75
Philadelphia	43.00	.336	.648	2.835	8.68	175.00	210.00	.54	1.80	52.37[s]	41.35[s]	53.39[s]	42.57
Pittsburgh	49.00	.182‡	.351‡	1.62‡	4.92‡	69.00	108.00	.75c	1.75	69.5	61.5	67	58.5
St. Louis	46.00	.255	.459	1.836	3.96	85.00	170.00	.80	2.00	51.266	40.245	52.49	41.47
San Francisco	47.00	.29	.522	2.088	5.67	103.50	172.50	.45	2.20	54.54	45.03	44.57	32.16
Seattle	48.50	.4225	.63†	3.06†	7.55†	85.00	200.00†	.50†	1.80	65.80	57.25	66.75	56.30

*b. & s. class B and heavier, C/L lots, 200 tons and over. Burlington, N. J. (base) $43.00. Gas pipe and class A, $3 per ton additional, 4-in., $3 per ton additional. 30 in. and larger usually $2 per ton less.

#Discounts from standard list for delivery from warehouse, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ½ in., 8½c; ¾ in. 11½c.; 1 in 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92.

[k]2½ to 3 in. [s]Resale price to consumer, car load lots shipped from mill.

‡f.o.b. †Less 30% in C/L Lots. c Concrete Culvert pipe reinforced. dDouble strength. tSales & municipal taxes extra

LUMBER AND TIMBER—PER M FT. B.M., CARLOAD LOTS F.O.B.

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. All Fir planks No. 2 common; Fir timber is No. 1 common. Lengths up to 20 ft.									LONG LEAF Y. P. Merchantable grade up to 20 ft.	
		1x6,[S]	1x8,[S]	2x4,[S]	2x6,[S]	2x8,[S]	2x10,[S]	3x12,[R]	6x12,[R]	12x12,[R]	2x12,[R]	12x12,[R]
Atlanta	Southern Pine	$17.50	$17.50	$19.50	$19.50	$19.50	$21.50	$25.00	......	.....	$38.50	$40.00
Baltimore	Southern Pine	23.50	24.50	27.50	26.50	27.00	29.00	37.50	.....	.....	55.00	58.00
	Douglas Fir	29.50	29.50	28.50	28.50	28.50	29.50	30.50	$32.50	$31.00	.....	.....
Birmingham	Southern Pine	21.00	21.00	22.00	20.00	21.00	23.00	30.00	30.00	28.00	.....	.....
	Long Leaf	22.00	22.00	25.00	24.00	25.00	28.00	45.00	.....	.....	45.00	45.00
Boston	Southern Pine	26.00	26.00	32.00†	32.00†	47.00†	55.00†	70.00†	.....	.....	70.00	53.00
	Douglas Fir	26.00	26.00	32.00	32.00	35.00	35.00	40.00	40.00	40.00	.....	.....
Chicago	Southern Pine	29.50	29.50	33.50	32.50	32.50	35.50	45.50	.....	.....	54.50	54.50
	Douglas Fir	34.50	35.50	39.50	37.50	38.50	39.50	41.50	41.50	41.50	.....	.....
Cincinnati	Southern Pine	23.00	25.00	26.00	25.00	25.50	26.50	40.00	.....	.....	31.50	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	43.50	46.25	46.25	.....	.....
Cleveland	Southern Pine	30.00	32.00	38.00	32.00	36.00	38.00	49.00	.....	.....	52.00	64.00§
Dallas	Southern Pine	d28.35	30.60	31.50	29.80	30.15	30.15	50.40	.....	.....	42.75	67.95
Denver	Douglas Fir	42.00	42.00*=	43.00*	43.00*	43.00*	47.00*	52.00*	56.00*	61.50	.....	.....
Detroit	Southern Pine	24.00	24.00	25.00	24.50	24.50	25.50	35.00	.....	.....	29.00	41.50
	Douglas Fir	.....	.....	.....	.....	.....	.....	41.50	41.50	41.50	.....	.....
Kansas City	Southern Pine	26.50	27.50	26.50	25.50	26.50	28.00	37.00	.....	.....	55.00	62.50
	Douglas Fir	28.50	29.50	30.00	27.50	28.00	30.00	35.00	37.00	37.00	.....	.....
Los Angeles	Douglas Fir	31.00[y]	31.00[y]	31.00[y]	31.00[y]	31.00[y]	31.00[y]	38.00[y]	48.00[y]	41.00[y]	.....	.....
Minneapolis [c]	Western Pine	45.00*	51.50*	50.00*	41.00*	41.00*	42.00*	59.50*[k]	.....	.....	58.00*[k]	.....
	Douglas Fir	42.00*	42.00*	43.00*	43.00*	43.00*	43.00*	55.00*	59.50*	59.50*	.....	.....
Montreal	Spruce	31.00	32.00	28.00	27.00	30.50	39.25	41.00	.....	.....	.....	.....
	Douglas Fir	47.50	53.00	42.50	44.00	44.00	45.75	51.00	51.00	51.00	43.00	.....
New Orleans	Southern Pine	23.50	25.50	28.00	25.00	27.00	25.50	38.00	.....	.....	44.00	54.00
	Douglas Fir	28.50	30.00	33.00	29.00	32.00	33.50	37.00	.....	.....	.....	.....
New York	Southern Pine	33.00*	34.00*	33.00*	34.00*	34.00*	38.00*	45.00*	.....	.....	70.00*	70.00*
	Douglas Fir	.....	.....	37.00*	37.00*	35.00*	38.00*	40.00*	43.00*	43.00*	.....	.....
Philadelphia	Southern Pine	30.00	31.00	32.00	32.00	33.00	34.00	36.00	.....	.....	36.00	42.00
	Douglas Fir	45.00	45.00	45.00	45.00	45.00	45.00	45.00	42.00	42.00	.....	.....
Pittsburgh	Southern Pine	30.50	31.90	37.65	33.75	36.52	37.50	47.75	.....	.....	57.50	57.50
	Douglas Fir	38.52	39.70	39.70	38.55	39.10	39.38	53.25	53.25	53.25	.....	.....
St Louis	Southern Pine	30.50*x	31.50*x	32.00*x	30.50*x	31.50*x	32.50*x	47.00*x	.....	.....	.....	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	.....	55.00*x	55.00*x	72.00	71.00
San Francisco	Douglas Fir	20.50[t]	20.50[t]	21.00[t]	21.00[t]	21.50[t]	22.50[t]	22.00[t]	25.00[t]	25.00[t]	.....	.....
Seattle	Douglas Fir	=15.50	15.50	15.50	14.50	14.50	14.50	21.00	20.00	20.00	.....	.....

*Delivered. †Spruce. ‡Long-leafed Y .P. §Norway Pine. [k]Northern Pine. =Native. [t]At ship's tackle. [y]Yard prices. d10% Disc. taken off. x5M ft. or less [S]S4S. [R]Rgh. [c]Contractors in Minneapolis and St. Paul get 15% disc. from list.

CURRENT BUILDING AND CONSTRUCTION WAGE RATES PER HOUR

	Bricklayers	Carpenters	Structural Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$0.70/1.125	$0.40/.90	$0.60/1.25	$0.75/1.50	$0.60/1.00	$0.30/.40	$0.30/.40
Baltimore	1.25	1.10	1.37½	1.25	1.25	.45	.45
Birmingham	1.00	.60/1.00	1.00	1.125	1.00	.30/.40†	.30/.40†
Boston	1.30	.70/1.175	1.20	.90/1.175	1.375	.50/.70	.50/.70
Cincinnati	.80/1.375	.65/1.20	1.25	1.00/1.25	.80/1.375	.45	.45
Chicago	1.50	1.50	1.50	1.50	1.50	.95	.95
Cleveland	1.375	1.25	1.25	1.25	1.375	.82	.82
Dallas	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.25/.40	.25/.40
Denver	1.10	1.10	1.10	....	......	.50	.50
Detroit	1.25	.90/1.00	1.125/1.25	1.00/1.25	1.25	.50/.75	.50/.75
Kansas City	1.325	1.125	1.25	1.25	1.325	.70	.45/.50
Los Angeles	1.10	1.10	1.125	1.125	1.25	.50	.60
Minneapolis	1.00/1.25	.85/1.00	1.00/1.25	.85/1.25	1.00/1.25	.50/.675	.50/.675
New Orleans	1.00	.75	1.00	1.00	1.25	.30/.40	.30/.40
New York	1.50	1.40	1.475/1.65	1.50/1.5625	1.50	.82½	.50/.80
Philadelphia	.35/1.50	.65/1.10	.70/1.375	.90/1.00	1.10/1.37	.35/50	.40/.50
Pittsburgh	1.00/1.50	1.00/1.25	1.00/1.375	1.00	1.00/1.50	.70	.50
St. Louis	1.50	1.25	1.47	1.35/1.47	1.50	.78¾	.35/.78¾
San Francisco	1.50*	1.125	1.37½	1.12½	1.25*	.62½	.60
Seattle	1.00	1.00	1.25	1.25	1.25	.60	.60
Montreal	.70	.60	.80	.55	.70	.35	.40

Skilled Avg: (Bricklayers, Carpenters, Ironworkers) $1.138 Common Avg. $0.558 *6-hr. Day . † PWA .

CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Ark., Bentonville—City soon takes bids waterworks improvement, $43,000. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs. Noted Sept. 30, C. D.—Oct. 3, E. N.-R.

Calif., Santa Cruz—S. A. Evans, city clk., rejected bids Apr. 13, furnishing 2 steel filter tanks, 8 ft. diam., 20 ft. in length, sidewalls 5/16 in. thick, heads or ends, ⅜ in. thick, electrically butt welded for operating pressure of 50 lb. per sq.in., also 8 in. galvanized steel header, drilled and lapped similar to present strainer system and 2 complete sets of 1¼ in. galvanized steel laterals with brass eyelets. To purchase in open market. Noted Apr. 22, C. D.

Conn., Mansfield—City making plans rebuilding dam damaged by flood, Pumping Station Pond. $100,000. J. F. Collins, Willimantic, city engr. S. B. Palmer, Thayer Bldg., Norwich, consult. engr. Noted Mar. 26, C. D.—Apr. 2, E. N.-R., under "Willimantic."

Okla., Enid—City voted bonds for 6 in. water wells and c.i. pipe line. $140,000. C. L. Lewis, Enid, engr.

BIDS ASKED

Calif., Fontana—June 18, by Fontana Union Water Co., constructing 1 circular ring tension type 3 m.g.c. rein.-con. reservoir for water supply system. To exceed $23,000. P. B. Hasbrouck, Fontana, mgr.

Calif., Salinas—F. E. Hepple, city clk., taking bids constructing pumping station and installing centrifugal sewage pumps in Sausal St.

★ **Colo., Colorado Springs**—May 15, by City, E. Mosley, engr., constructing South Catmount Creek Dam, granite gravel dam, with electric welded steel plate face, concrete lined spillway and concrete outlet tunnel, on north slope of Pike's Peak. Est. $600,000, incl. $88,000 P.W.A. grant. Noted Apr. 24, C. D.—Apr. 30, E. N.-R.

Mass., Athol—May 15, by Town, Bd. Water Comrs., Memorial Bldg., constructing mechanical filtration plant and equipment, P.W.A. Project 1083-R (part). $46,500. Tighe & Bond, 189 High St., Holyoke, engrs.

Mich., Gaylord—May 12, by G. R. Thompson, state budget dir., Lansing, erecting one new 60,000 gal. elevated steel water tank, with alternate for dismantling, moving and erecting existing 75,000 gal. elevated tank at old state prison, Jackson, P.W.A. 11-1-R. Michigan Dpt. Health, 607 State Office Bldg., Lansing, engrs.

Mo., Liberty—See "Contracts Awarded."

N. J., Andover—May 12, by Boro, constructing waterworks. $50,000. P.W.A. project. H. A. Kelly, 931 Bergen Ave., Jersey City, archt.

N. Y., Brocton—May 11, by Village Bd., C. J. Coughlin, clk., general construction water filtration plant, auxiliary water line, pumping station. $68,728. P.W.A. and W.P.A. project.

N. Y., Elmira—See "Contracts Awarded."

N. Y., Endicott—See "Contracts Awarded."

†**N. Y., West Point**—May 14, by Con. Q.M., U. S. Military Academy, West Point, furnishing, installing water meters and depth gages.

Pa., York Springs—See "Contracts Awarded."

Ont., London—May 12, by J. M. Somerville, secy. Dpt. P. Wks., Hunter Bldg., Ottawa, fire protection system at Westminster Soldiers Hospital, incl. installation pump, c.i. watermains, 6 in. valves and hydrants and 50,000 imperial gal. rein.-con. reservoir. $50,000.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. Directors Metropolitan Water Dist., 306 West 3rd St., F. E. Weymouth, engr., furnishing, erecting 1 steel head frame and trestle at Lawrence adit of San Jacinto Tunnel, near Banning, Spec. 152, to Bethlehem Steel Co., East Slauson Ave., Vernon, $8,449. Bids Apr. 22, awarded Apr. 24.

Calif., San Francisco—Dpt. P. Wks., constructing three 75,000 rein.-con. fire cisterns under Group 5, AWSS for fire protection, to Eaton & Smith, 715 Ocean Ave., $18,461. Est. $23,000. Awarded Apr. 27. Noted Apr. 22, C. D.—Apr. 16, E. N.-R.

Minn., Lafayette—Village, furnishing, installing pumping equipment for waterworks system, to Central Supply Co., 314 South 3rd St., Minneapolis, $1,375***furnishing, constructing 11x14 ft. hollow tile pump house, to Arlington Cement Stone Wks., Arlington, $944. P.W.A. project. Bids Apr. 15. Noted Apr. 2, C. D.—Apr. 9, E. N.-R.

Minn., Onamia—Village, W. J. Eynon, clk., furnishing, installing pumping equipment, to Central Supply Co., 314 South 3rd St., Minneapolis, $704; 11x14 ft. hollow tile and stucco pump house, to A. Belkins, Onamia, $790. Bids Apr. 7. Noted Apr. 14, C. D.—Apr. 2, E. N.-R.

Mo., Liberty—City, installing 21,000 ft. 10 in. water lines, relief forces. $75,000. W.P.A. W. E. Barnes, city engr.

N. Y., Elmira—City, concrete settling basin in connection with new W.PA., filtration plant (now under construction), by relief labor. W.P.A. project. C. C. Hunter, city mgr. J. G. Coples, c/o Elmira Water Bd., Elmira, engr. Owner will purchase materials.

N. Y., Endicott—Village, laying watermains in new development near Green St., by International Business Machine Corp., Endicott, by own forces. Owners will purchase materials. To exceed $23,000. C. G. Hunt, village engr.

N. Y., Sodus Point—Town, waterworks, intake filter, coagulation basin and appurtenances, to W. L. Lose, 171 Elwood Park, Tonawanda. Est. $62,490. **P.W.A.** Bids Apr. 6. Noted Apr. 13, C. D.—Mar. 26, E. N.-R.

†**N. Y., West Point**—Con. Q.M., United States Military Academy, constructing two 500,000 gal. steel tanks, piping and accessories, to Chicago Bridge & Iron Co., 165 Bway., New York, $47,900***installing 2 electric motor driven centrifugal pumps, control equipment, piping, etc., in Intermediate Level Pumping Station, to Gill & Simpson Electric Co., 122 Hollingsworth St., Baltimore, Md., $6,352***completing water filtration plant additions, to Suburban Eng. Co., 15 West 38th St., New York, $59,336. Grand total $113,588. Bids Apr. 21. Noted Apr. 23, C. D.—Apr. 2, E. N.-R.

N. C., Wake Forest—Mayor and Bd. Town Comrs., furnishing, erecting 500,000 gal. tank and tower, to Taylor Iron Wks., Macon, Ga., $13,931. Bids Apr. 16. Noted Apr. 10, C. D.—Dec. 26, E. N.-R.

Pa., York Springs—Borough, constructing municipal water supply system, day labor under supervision of L. H. Winebrenner, Gettysburg, engr. $36,500. Borough will purchase about $12,500 worth of materials and equipment.

Tex., Decatur—City, c/o A. Ingram, mayor, drilling 2 shallow water wells, to Q. D. Lewis, Saginaw St., Fort Worth. Est. $17,500. **P.W.A.** Bids Feb. 14, awarded Apr. 22. Noted Feb. 21, C. D.—Feb. 6, E. N.-R.

SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Calif., Menlo Park — Menlo Park Sanitary Dist. voted $28,000 bonds to finance construction of sanitary sewers to connect with present Menlo Park Outfall into San Francisco Bay. Total est. $108,000. Balance of funds to be provided by Federal Government. B. Mehl, 1372 Highway, Menlo Park, engr. Noted Apr. 8, C. D.—Apr. 16, E. N.-R.

Calif., Pasadena — City plans constructing storm drain through city farm, to protect city's sewage disposal plant from storm waters, incl. construction of 2 bridges and rebuilding trestle carrying main outfall. $150,000. G. K. Hooper, City Hall, engr. Application will be made for federal aid under flood control program of U. S. Army Engineers.

†**Miss., Greenville**—U. S. Eng., Vicksburg, soon takes bids constructing outfall sewerage system.

N. M., Portales—Town soon takes bids extending present sewerage system and renovating sewage disposal plant. $26,500. E. M. Gibbon, Portales, engr.

Pennsylvania—Comrs. Radnor and Haverford Twps., soon takes new bids Contr. 2, sewerage disposal plant and sanitary sewerage system. $280,000. Former contract rescinded. C. F. Mebus, Glenside, consult. engr. Noted July 18, C. D.—July 25, E. N.-R., under "Contracts Awarded."

Pa., New Brighton—Borough making plans 2 story, 23x40 ft., brick, stone incinerator, incl. furnace and stack blower and motor. Est. $27,000. R. Steinfield, Borough Bldg., engr.

BIDS ASKED

★ **Mich., Detroit**—May 22, by Dpt. P. Wks., constructing Sect. 12, Detroit River Interceptor in Jefferson Ave. from sewage treatment plant site to Solvay Ave. $500,000. P.W.A. project. J. S. Stringham, city engr.

★ **Mich., Detroit**—May 22, by Dpt. P. Wks., 104 City Hall, constructing Sect. 11, Detroit River Interceptor Sewer in Jefferson Ave. from Solvay to Military Aves. $500,000. Former contract rescinded. P.W.A. project. J. S. Stringham, city engr. Noted Apr. 14, C. D.—Apr. 16, E. N.-R., under "Contracts Awarded."

Miss., Nettleton—May 26, by Mayor and Bd. Aldermen, constructing waterworks and sewage disposal system; Sect. 1, deep well and pump; Sect. 2, general contract consisting distributions systems, elevated tank, pumping stetion, disposal plant. $60,000. P.W.A. project. Totten & Loving, Atlanta, Ga., engrs. Noted Sept. 23, C. D.—Sept. 26, E. N.-R.

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Projects $500,000 and over symbol ★

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C. D. Construction Daily

E. N.-R. Engineering News-Record

Federal Government projects symbol †

◆

N. Y., Rochester—See "Contracts Awarded."

N. Y., Stella — May 16, by Town Bd. of Dickinson, at office N. D. Clearwater, town clk., Port Dickinson, constructing storm sewerage system in Stella Sewer District. $27,000. P.W.A. project. Nussbaumer, Clarke & Phelps, 518 Security Mutual Bldg., Binghamton, consult. engrs. Noted Apr. 28, C. D.—Apr. 30, E. N.-R.

N. Y., Yonkers—May 14, by City, constructing sewers in Gladstone Pl., Clover St., Edgewood, Odell and Etville Aves. To exceed $23,000. C. Sheridan, city engr. P.W.A. project.

N. Y., Yonkers — May 15, by Westchester County Sanitary Sewer Comm., 148-166 Martine Ave., White Plains, constructing Sect. C-1 South Yonkers Project, incl. 1,350 lin.ft. 14 in. c.i. pipe; 300 ft. 14 in. c.i. force main with appurtenances. $40,526. P.W.A. project. W. W. Young, c/o owner, consult. engr.

O., Columbus—May 12, by P. W. Maetzel city engr., macadam and brick repaving over West 5th and West 3rd Aves., Storm Sewers, Contr. 74, Part 3. $11,897. P.W.A. project.

Va., Ashland—May 15, by Bd. Water Comn., constructing two sewage pumping stations. Wiley & Wilson, American Natl. Bank Bldg., Richmond, consult. engrs.

CONTRACTS AWARDED

Conn., Hartford — Metropolitan Water Dist., Bureau P. Wks., constructing 8,000 ft. 8, 24 and 38 in. sanitary sewers, Blue Hills Dist., Bloomfield, Contr. 1, to N. C. Casciano, 23 North Main St., West Hartford, $58,718. Bids Apr. 7, awarded Apr. 28. Noted Apr. 16, C. D.—Mar. 19, E. N.-R.

★ **Minn., Minneapolis**—City, constructing 7,811 lin.ft. 6½ ft. x 6½ ft. semi-elliptical section, concrete lined sewer, Contr. 308, Div. A. Job 130M, East River Rd. from Mississippi River crossing to Oak St. S.E., $282,050; 10,344 lin.ft. 4½x6½ ft. semi-elliptical section concrete lined, Contr. 309, Div. B, Job 1300 M on east side Mississippi River through University of Minnesota Campus on projected line of 2nd St. S.E., to Main St. and 2nd Ave. S.E., $269,550; 5,300 lin. ft. 3½x6 ft. semi-elliptical concrete sewer in tunnel, Contr. 312, Div. C, Job 1400 M in park property, along Hiawatha Ave. from Minnehaha Parkway to East 52nd St., thence in Snelling Ave. to 350 ft. north of East 54th St., $122,450; 5,280 lin.ft. 42 in. circular concrete sewer in open trench, Contr. 313, Div. A, Job 1500 M in Marshall St. N.E., from 22nd Ave. to 26th Ave., in 26th Ave. from Marshall to Randolph Sts., in Randolph St. from 6th to 31st Aves., $116,177, all by day labor under supervision of F. T. Paul, city engr. Received no bids Apr. 23. Grand total $790,227. Bids Apr. 23. Noted Apr. 16, C. D.—Dec. 12, E. N.-R.

New York—Dpt. Sanitation, 125 Worth St., New York, repairing and altering clam shell buckets in incinerators at 215th St., Manhattan Boro, Zerega Ave., Bronx Boro, Flatlands and Greenpoint, Brooklyn Boro, and Ravenswood, Queens Boro, to Hayward Co., 50 Church St., New York, $8,500. Bids Apr. 6. Noted Apr. 7, C. D.

N. J., New Providence—Boro, Contr. B, general contract constructing sewage disposal plant, to Suburban Eng. Co., 15 West 38th St., New York, $83,198***Contr. C, superstructure, to Calabro Constr. Co., 529 4th Ave., Elizabeth, $6,877***Contr. D, plumbing, to Richardson Eng. Co., 15 West 38th St., New York, $1,145 ***Contr. E, heating and ventilating, to Suburban Eng. Co., 301 Burnett St., New Brunswick, $3,644***Contr. F, electrical work, to J. J.

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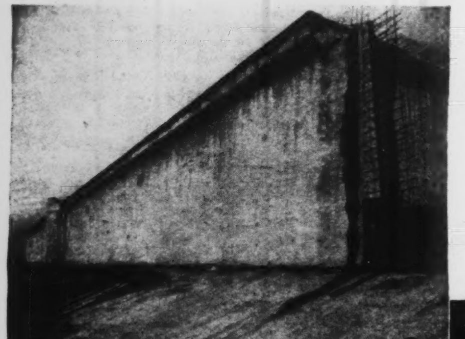
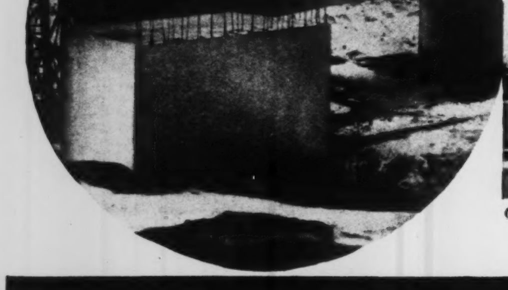


{Above} City of Cleveland Water Reservoir, Parma, Ohio, The Hunkin-Conkey Co., Contractors.

{At right} Lakeside Exhibition Hall, Cleveland, O. Geo. S. Rider Co., Engineers. General Contractor, Sam W. Emerson Co.—26,000 yards of concrete poured.



{Below} Erie Railroad Bridge, Buffalo, New York. Freeman & Jones, Contractors.

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MASTER BUILDERS

Sewerage, etc. (Continued)

Tomasulo, Inc., 531 Westfield Ave., Roselle Park. $4,995. Grand total $98,859. **P.W.A.** Noted **Apr. 21, C. D.—Apr. 23, E. N.-R.**

N. Y., Rochester—City, constructing combination sewer and reconstructing present sewer in Edgarton Park, reconstructing Costar St. Combination Sewer from Parkway to Dewey Ave., to exceed $23,000; reconstructing Child St. Combination Sewer from Lime St. to Lyell Ave., to exceed $23,000; reconstructing Buchanan Park Combination Sewer from Clinton Ave. North, $29,000, relief labor. **W.P.A.** A. Hackett, 1460 South Ave., procurement officer W.P.A., will purchase materials.

O., Berea—City, constructing Contr. 1, sewer line for sewage disposal plant, to Phillips Constr. Co., 4816 Brookpark Rd., Cleveland, $28,985. **P.W.A.** Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

O., Columbus—City, constructing 6,000 ft. storm sewer in Oakland Park Dist. Contr. 67 Part 2, to Fritz-Pyle Constr. Co., 1400 North Grant Ave., $64,970. Est. $85,500. **P.W.A.** Noted **Apr. 17, C. D.—Apr. 23, E. N.-R.**

Pa., Radnor—Bd. Comrs. Radnor Twp., sanitary sewers along Ithan Creek from Wayne to Haverford Twp. line, to Acchione Contg. Co., 1607 McKean St., Phila., $134,691. **P.W.A.** Noted Mar. 13, C. D.—Mar. 19, E. N.-R.

Ont., Port Arthur—City Council, constructing 40 ton weekly capacity incinerator on waterfront, to Phoenix Refuse Converter Co., Regina, Sask. Noted Nov. 15, C. D.—Nov. 21, E. N.-R.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Connecticut—State Hy. Dpt., State Office Bldg., Hartford, making plans permanent repairs to Ansonia-Derby Bridge over Housatonic River, to replace flood damage. Est. $125,000. J. A. Macdonald, State Office Bldg., Hartford, state hy. comr.

Iowa—State Hy. Comn., Ames, soon takes bids constructing one 160x24 ft. continuous I-beam overhead bridge, incl. 275 cu.yd. Class 1 excav., and one 150x20 ft. continuous I-beam bridge, 45 cu.yd. Class 1 and 90 cu.yd. Class 2 excav., on secondary road north, west of Doon, at G. N. Ry. crossing, Lyon Co.; one 180x24 ft. continuous through plate girder span, two 28x24 ft. concrete deck girder span and six 37x24 ft. I-beam approach span multiple span overhead crossing structure on U. S. Rd. 18, west of Boyden, at C. M. St. P. & P. R.R., Sioux Co.; one 150x20 ft. continuous I-beam bridge and 1 rein.-con. box culvert on secondary road, between Sects. 15 and 22, Taylor Co.; one 134x24 ft. continuous I-beam overhead bridge, 1 rein.-con. box and 2 rein.-con. pipe culverts on secondary road, at M. & St. L. R.R. crossing, south of Albion, Marshall Co., 282 cu.yd. Class 1 excav. F. R. White, ch. engr.

Missouri — State Hy. Dpt., Jefferson City, plans one 12 ft. rein.-con. slab span bridge, one 25 ft. and two 30 ft. rein.-con. girder span bridges, all over Town Creek, two 10 ft. rein.-con. slab spans over Rush Creek on Liberty North and South Hy., two 10 ft. rein.-con. slab spans over Nichols Branch, Kansas City North, all foregoing Clay Co.; three 10 ft. rein.-con. slab span bridges over stream, Ashburn to Route ST Rd.; one 35 ft. and two 20 ft. rein.-con. I-beam span bridges, concrete floor, over Fox Creek; five 12 ft. rein.-con. slab spans, creosoted pile bents over stream; one 30 ft. I-beam span bridge, concrete floor over stream; five 16 ft. rein.-con. slab spans, concrete floor, creosoted pile bents over drainage ditch; three 14 ft. rein.-con. slab spans, concrete floor, creosoted pile bents, over drainage ditch; one 16 ft. rein.-con. slab span bridge over stream; one 12 ft. rein.-con. slab span over stream; one 16 ft. rein.-con. slab bridge over stream; one 16 ft. rein.-con. slab span over stream; one 14 ft. rein.-con. slab span bridge over drainage ditch, all foregoing on Hannibal-St. Louis Rd., Pike Co.; one 12 ft. rein.-con. slab span bridge over stream on Route 61 to Route SH; two 10 ft. rein.-con. slab span bridge on New London East, both Ralls Co.; one 345 ft. and two 165 ft. self-anchored suspension bridge, pre-stressed cables, piers and bents over upper Arm of Lake of the Ozarks, Warsaw to Clinton Rd.; and one 45 ft. and four 21 ft. steel girder spans over Chicago, Rock Island R.R. tracks, Versailles to Cole Camp, both Benton Co.; three 41 ft. I-beam spans bridge, concrete floor, over Lime Creek; two 10 ft. rein.-con. slab bridges over Henson Creek, and one 12 ft. rein.-con. slab bridge over Lintin Creek, all foregoing on Kansas City North; three 10 ft. rein.-con. slab span bridge over Pedee Creek; three 30 ft. I-beam spans over Mission Branch; three 40 ft. I-beam spans over Sugar Creek, three 25 ft. I-beam spans over Short Creek; and one 16 ft. rein.-con. slab span bridge over Sherman Branch, Parkville to Weston Rd., all foregoing Platte Co.; three 41 ft. I-beam bridge over Lick Creek; two 10 ft. rein.-con. slab span bridge over Lost Creek and two 45 ft. I-beam bridge over Knobb Creek, all Cass Co.; two 12 ft. rein.-con. slab bridge over Big Bill Creek; three 18 ft. rein.-con. slab span bridge over drainage ditch, on Hannibal-St. Louis Rd.; and one 12 ft. rein.-con. slab span bridge over stream, Hawk Point-Silex Rd., all foregoing Lincoln Co.; constructing two 34½ ft. and one 39 ft. I-beam span bridge, concrete piers and bents on Mobberly East and West Rd., Randolph Co.; one 44 ft. steel plate girder span bridge, concrete abutments under Chicago & Alton R.R., Layette Co.; two 10 ft. rein.-con. slab spans over Rapid Branch, Monroe Co.; three 12 ft. rein.-con. slab spans over Cave Creek, Hannibal Southeast, Marion Co.; one 20 ft. rein.-con. slab span bridge, concrete substructure over drainage ditch, Callaway Co.; five 20 ft. rein.-con. slab span bridge over Foremans Branch, Memphis east and west, Scotland Co. T. H. Cutler, Jefferson City, state hy. engr.

Mo., St. Louis—State Hy. Dpt., Jefferson City, granted permission by Bd. Public Service, to construct rein.-con. viaduct to carry Bircher Blvd. across tracks of Terminal R.R. Association between Kingshighway and Euclid Ave., and reconstructing and widening bridge on Loughborough Ave. crossing Missouri Pacific R.R. tracks between Grand Blvd. and Colorado Ave., near Carondelet Park. Hy. Dpt. will pay cost of construction of above bridges, while the city will purchase necessary rights-of-way.

★ **Mo., St. Louis—City has filed its assent with** Missouri State Hy. Dpt., Jefferson City, to the plans proposed by Hy. Dpt., Wabash Railway Co., E. L. Crugar, ch. engr., Railway Exch. Bldg., and St. Louis Public Service Co., for eliminating grade crossings on Wabash tracks at DeBaliviere, Waterman and Hamilton Aves., incl. 4 overhead crossings, depressing tracks more than 1 mi. from Union to Delmar Blvds. $650,000. The contracts are to be let by Hy. Dpt. and financed through federal funds allotted the state. Preliminary contracts have already been awarded.

N. Y., Buffalo—Bd. Supervs. Erie Co., County Bldg., soon takes bids constructing 8 steel, concrete bridges and improving 26 county roads.

N. Y., Syracuse—New York Central R.R. Co., J. W. Pfau, ch. engr., 466 Lexington Ave., New York, making plans constructing 30 ft. rein.-con. approach span at either end of Hiawatha Blvd. Bridge, in connection with grade crossing elimination. To exceed $23,000.

Oklahoma—See "Contracts Awarded."

Tex., Ruliff—Kansas City Southern Railway Co., A. N. Reece, ch. engr., Kansas City, Mo., plans railway bridge or trestle across Sabine River, near here. It is planned to practically rebuild bridge and reconstruct modern type one, providing a plate girder swing span with 2 navigation openings in middle of river. Lt. Col. E. H. Marks, Fed. Dist. Eng., Trust Bldg., Galveston, will have general supervision of plans and construction.

★ **B. C., Vancouver**—British Pacific Properties, Ltd., 675 West Hastings St., plans approved by Dominion Govt. for 5,550 ft. 3 spans and approaches suspension bridge with concrete caissons ,entrance to Vancouver Harbor, $6,000,000. Plans expected to be ready for bids about August. W. G. Swan, Birks Bldg., engr. Monsarrat & Pratley, Drummond Bldg., consult. engrs.

Man., Winnipeg—City soon takes bids constructing subway on Portage Ave. $132,000. Noted Oct. 28, C. D.—Oct. 31, E. N.-R.

Ont., New Toronto—New Toronto, Etobicoke Twp., and Canadian National Ry. plan bridge to carry tracks over 18th St. and C. N. Ry. $225,000.

BIDS ASKED

Connecticut—See "Streets and Roads."

Florida—May 14, by State Road Dpt., Tallahassee, C. B. Treadway, chn., J. H. Dowling, state hy. engr., constructing grade crossing overpass structure consisting of four 39 ft. concrete deck girder spans on concrete piers with 12 in. precast concrete piling, four 39 ft. concrete deck girder spans on 18 in. precast concrete pile bents, over S. L. and S. F. Ry., W.P.G.H. 35-B and U. S. Works Program Hy. Project W.P.M.S. 221, Escambia Co.; overpass structure over S. A. L. R.R., comprised of three 50 ft. steel I-beam spans, etc., Rd. 5, W.P.G.M. 194-B, Hernando Co.

Ia., Clinton—May 12, by Clinton Co., W. B. Gode, aud., constructing one 6x6 ft. rein.-con. box culvert, raising, widening one 16x16 ft. I-beam bridge; re-erecting one 50x16 ft. truss with 2 wooden approach spans on creosoted wood substructure and re-erecting two 55x16 ft. truss bridge on creosoted wood substructure. E. B. Lorenzen, co. engr.

Iowa—May 12, by State Hy. Comn., Ames, constructing 2 rein.-con. pipe and 4 rein.-con. box culverts on secondary road east of Backbone State Park, Delaware Co., incl. 281 cu. yd. Class 1 excav.; one 122x24 ft. continuous I-beam bridge on relocation Primary Rd. 154, Arlington, WPGM 611-F, Fayette Co., 170 cu. yd. Class 1 and 110 cu.yd. Class 2 excav.; 1 concrete box and 1 concrete pipe culvert, on secondary road northwest of Doone at G. N. Ry., WPGS 648-A, Lyon Co., 200 cu.yd. Class 1 excav.; 1 concrete box culvert on U. S. Rd. 169, south of Winterset, F-169, Madison Co., 600 cu.yd. excav.; one 132x24 ft. cantilever through plate girder overhead crossing structure and 1 rein.-con. pipe culvert on Rd. 63, and M. & St. L. Ry. crossing, WPGH 70-C, Mahaska Co., 1,045 cu.yd. excav.; 14 corrugated metal pipe and 4 rein.-con. pipe culverts, 7 rein.-con. box culverts and extensions on sec-

40 TO 1

This is the relative space required for drying sludge on sand filter beds in a city of 100,000 population, contrasted with that occupied by the Nichols Herreshoff Incinerator to assure complete disposal. The sludge bed area is approximately 100,000 sq. ft. and the incinerator area about 2,500 sq. ft. .. in the ratio of 40 to 1.

THE OLD WAY AND THE NEW

Convincing proof of the compactness of Nichols Herreshoff Sewage Sludge Incinerator installation is afforded by these comparative figures. They clearly indicate the economy of space made possible by this improved, scientific way to dispose of sewage sludge solids by *burning*. The resulting residue is a dry, odorless, virtually inorganic ash. Minimum labor and maintenance costs also assure maximum economy of operation.

* * *

Engineers and public officials interested in solving municipal waste disposal problems by this economical, sanitary method are invited to send for more complete details.

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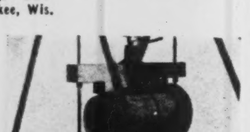

Blackhawk Hydraulic Jack Model D 11 G (12 ton) determining strength of concrete pipe.

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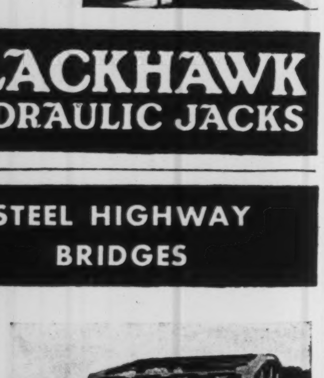

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Bridges, etc. (Continued)

ondary road, south of Hawthorne, Montgomery Co., 950 cu.yd. excav.; 1 rein.-con. box and 1 rein.-con. pipe culvert on secondary road at C. B. & Q. crossing north of Hawthorne, Montgomery Co., 305 cu.yd. excav.; 1 corrugated metal pipe and 5 rein.-con. pipe and 4 rein.-con. box culverts on secondary road, WPSO 695, Polk Co., 280 cu.yd. excav. F. R. White, ch. engr.

Kansas—See "Streets and Roads."

Louisiana—See "Streets and Roads."

Minnesota—May 15, by State Hy. Dpt., St. Paul **(S. P. means State Project)** constructing 9 span concrete deck girder overhead, Lake Benton, S. P. 14-7-41-3 WPGM444C Bridge 5445, Lincoln Co.; three span beam overhead, New London, S. P. 23-210-221-1a, WPGMS556A, Bridge 5447, Kandiyohi Co.; three span deck girder underpass, incl. grading, graveling 0.3472 mi. S. P. 47-89-21-3A, WPGM489E, Bridge 5449, 20,399 cu.yd. excav., Pipestone Co.; five span overhead near Cambridge, S. P. 65-5-43-1, WPGH530B, Bridge 5479, Isanti Co.; double track beam span underpass, incl. grading 0.571 mi. S. P. 71-4-52-3A, WPGM 13, Bridge 5501, 47,301 cu.yd. excav., Redwood Co.; multiple beam span underpass and approaches, Project 27-001, WPGMS594A, Bridge 5594, Hennepin Co.; deck plate girder underpass on St. Anthony Blvd., Project 27-002, WPGMS59A, Hennepin Co.; 50 ft. beam span, incl. grading, graveling 1.1 mi. Project 82-04, WPSO851A, Bridge 5684, Washington Co., 20,120 cu.yd. excav.

New York—May 19, by A. W. Brandt, comr. Hys., Albany, constructing 165 ft., 110 ft. and 120 ft. trusses in Tioga Co.; three 125 ft. span truss bridges in Delaware and Otsego Counties; 259 lin.ft. multiple span I-beam bridge over Erie R.R. and paving 0.58 mi. road in Rockland Co.; 60 and 65 ft. girders and 45 ft. I-beam bridge on 0.43 mi. Schuyler and Tompkins Counties.

N. Y., Binghamton—May 19, by City, at office C. A. Harrell, city mgr., constructing extension of Ferry St. from Front to Clinton Sts. and 2 rein.-con. flat slab bridges to support tracks of Delaware, Lackawanna & Western R.R. and Erie R.R. over extension. Contr. 2. P.W.A. Project N. Y. 1322-R. $131,587. Noted Apr. 28, C. D.—Apr. 30, E. N.-R.

N. Y., Oneonta—See "Contracts Awarded."

★ **N. Y., Syracuse**—May 28, by Dpt. P. Wks., Albany, constructing underpass under New York Central and Delaware, Lackawanna & Western R.R. tracks at Geddes St. $500,000. Noted Mar. 19, C. D.—Mar. 26, E. N.-R.

Ohio—See "Streets and Roads."

Oklahoma—See "Contracts Awarded."

Wis., Superior—See "Streets and Roads."

CONTRACTS AWARDED

Alabama—See "Streets and Roads."

Fla., Jacksonville—Bd. Duval Co. Comrs., constructing creosoted timber, concrete bridge spans across McGirts Creek, on Timuquana Rd. and Jacksonville Heights Rd. across Fishing Creek and Timuquana Rd. and creosoted treated bridge across Cedar Creek at 64th St., to North American Constr. Co., 111 West Ashley St., Jacksonville, **$89,519*****creosoted timber, concrete bridges across Nine Mile Creek and Trout River Blvd., across McGirts Creek on Chaffee Rd. across Bog Pottsburg Creek, Hogan Rd. across Greenfield Creek on Girvin Rd., to H. R. Goyke & Co., Jacksonville, **$35,957*****erecting three double span concrete culverts on Hamilton Ave., erecting two double span concrete culverts on 53rd St. and one on Cassett Ave. and single span concrete culvert on Cassett Ave., to T. B. Gillespie, Palatka, **$11,168** and **$13,335** respectively. Grand total $149,979.

Ill., Chicago—Secretary Chicago Park Dist., Administration Bldg. of District, Burnham Park, constructing steel superstructure of Randolph St. viaduct across Illinois Central R.R. tracks, to Joseph T. Ryerson & Son, Inc., 2558 West 16th St., and Oscar Daniels Co., 135 South La Salle St., **$281,777. P.W.A.** Bids Apr. 21.

Indiana—State Hy. Comn., Indianapolis, 202 ft. steel, rein.-con. bridge in Noble Co., to H. Tharp, Fountain City, **$89,134** est. $102,866*** 156 ft. steel beam bridge in LaPorte Co., to Ryan & Ryan, Washington, **$19,062** est. $19,531 60 ft. steel beam, 32 and 28 ft. rein.-con. bridges and 36 ft. rein.-con. arch bridge in Montgomery Co., to C. Myers, Campbellsburg, **$32,938** est. $39,853***1 rein.-con. arch bridge and 8x6 ft. rein.-con. box culvert in Adams Co., to Yost Bros., Decatur, **$18,120** est. $19,037 ***40 ft. rein.-con. arch bridge in Wabash Co., to R. L. Schutt, 351 North Ritter Ave., Indianapolis, **$13,730** est. $14,413***two 54 and 105 ft. steel beam bridges and 1 rein.-con. steel beam bridge on creosoted wood piling in Gibson Co., to B. E. Curry Building Corp., 306½ West 5th St., Bloomington, **$22,452** est. $22,-893. Grand total $195,436. Bids Apr. 7. Noted Apr. 13, C. D.—Mar. 26, E. N.-R.

Kansas—State Hy. Comn., Chanute, constructing overpass Br. 6.5, 69-9, WPGS 427-D, Bourbon Co., to O. O. Fuller Constr. Co., Nevada, **$71,385*****viaduct, Br. 12.3, P. 54-30, WPGH 239-E, Greenwood Co., to Reece Constr. Co., Scandia, **$21,211*****subway, Br. 2.2, P. 54-30, WPGH 239-F, Greenwood Co., to [illegible] & Tidd, Hutchinson, **$14,995*****constructing 65x80x65 ft. I-beam span, Bd. 0.7, P. [illegible] WPMH 172-D, and subway, Br. 23.8, P. [illegible] WPGH 126-A, both Labette Co., to F. [illegible] Frees, tor, Pittsburg, **$24,518** and **$21,144** respectively ***Br. 3.7, P. 160-39, WPGM 198-B, and bridge over channel, P. 160-39, WPGM 198-[illegible] both Montgomery Co., to E. L. Powers & Son, [illegible] ley, **$3,875** and **$3,030** respectively***[illegible] ing alternate 1, steel viaduct, Br. 0.3, P. [illegible] WPGM 447-C, Neosho Co., to List & W[illegible], Railway Exchange, Kansas City, **$111,[illegible]*****160x200x160 ft. truss span, Br. 3.1, WPSO 541-B, Neosho Co., to Maxwell Constr. Co., Columbus, **$93,970*****rein.-con. deck girder Br. 2.2, P. 59-6, WPGH 172-B, Labette and Neosho Counties, to G. Rhoades Constr. Co., Newton, **$30,127*****subway, Br. 3.8, P. 160-39, WPGM 198-B, Montgomery Co., to Bushman Constr. Co., St. Joseph, Mo., **$20,642.** Grand total $487,240. Bids Apr. 21. Noted Apr. [illegible] C. D. —Apr. 9, E. N.-R.

Kansas—State Hy. Comn., Olathe, constructing two 14x12x32 ft. rein.-con. bridges Br. 12.0, WPSO 532, Osage Co., to Gru[illegible] Constr. Co., Holton, **$5,105*****constructing two 12x12x47 ft. rein.-con. bridges, Br. 5.[illegible] and three 35 ft. rein.-con. deck girder bridges Br. 9.6, WPSO 532, Osage Co., to L. Silven, Osage City, **$5,573** and **$7,897** respectively***three 41 ft. rein.-con. overpass, WPGM 545, Wyandotte Co., to J. O. Patterson, 1615 Main St., Kansas City, **$25,416*****four 16 ft. approach spans and 6 in. I-beam span Br. 8.2, P. 11-14B-WPGM 430-D, Lyon Co., to Cook & Ranson, Ottawa, **$13,203*****constructing extension to Goddard Ave. viaduct, P. 58-8-WPMH [illegible]-B, Wyandotte Co., to J. A. Tobin, 3700 Rainbow Blvd., Kansas City, **$29,646.** Grand total $86,840.

Kansas—See "Streets and Roads."

Louisiana — State Hy. Comn., Baton Rouge, **(P. means Project)**, to Robinson & Young, Baton Rouge, bridge and approaches 0.104 mi. Vivian-Rodessa Hy., P. 1852, **$21,979;** 0.075 mi. Shreveport-Arkansas Hy., P. 1852-A, **$14,318,** both Caddo Parish; overpass and approaches 0.803 mi. Minden-Shreveport Hy., P. 6954, USWP Grade Crossing WPGH 116-A, Webster Parish, **$93,691*****to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, Ia., and Swinney & Coleman, Baton Rouge, overpass and approaches 0.365 mi. Columbia-Monroe Hy., P. 2002, USWP Grade Crossing WPGH 14-A, Caldwell Parish, **$87,112*****to Pittsburgh-Des Moines Steel Co., 1015 Tuttle St., Des Moines, Ia., 0.33 mi. Port Allen-Livonia Hy., P. 7050, USWP Grade Crossing WPGH 185-C, West Baton Rouge Parish, **$90,181***** to Nelson Bros., Baton Rouge, 0.164 mi. Winnfield-Alexandria Hy., P. 7352, USWP Grade Crossing WPGM 325, Winn Parish, **$55,015.** Grand total $362,296. Bids Apr. 15. Noted Apr. 23, C. D.—Mar. 26, Apr. 2 and 9, E. N.-R.

Mass., Lawrence—Commonwealth of Massachusetts, Dpt. P. Wks., 100 Nashua St., Boston, W. F. Callahan, comr., A. W. Dean, ch. engr., 122 ft. through plate girder bridge with wrought iron deck plates, rein.-con. abutments, 1,360 sq.yd. granite block pavement in approaches Andover St., to Lathrop & Shea Co., 178 Goffe St., New Haven, Conn., **$63,623.** Bids Apr. 21, awarded Apr. 29. Noted Apr. 28, C. D.—Apr. 23, E. N.-R.

Michigan—See "Streets and Roads."

Minnesota—State Hy. Dpt., St. Paul, constructing deck girder underpass Bridge 5320, Kandiyohi Co., to Okes Constr. Co., E-1501 1st Natl. Bank Bldg., St. Paul, **$90,565*****Bridge 5484 and Bridge 5485, in Blue Earth, Faribault Co., to A. Guthrie & Co., 424 Endicott Bldg., St. Paul, **$119,873*****120 ft. Bridge 5469 and Bridge 5470, east of Wrenshall, Carlton Co., to Lenci, Lenci & Englund, Virginia, **$29,-333** and **$32,919** respectively***Bridge 5634 in Kittson Co., to M. R. Souther, 1528 East Branston St., St. Paul, and C. C. Pagenhart, Rochester, **$20,484.** Grand total $293,174. Bids Apr. 17. Noted Apr. 10, C. D.—Apr. 16, E. N.-R.

Missouri—State Hy. Comn., Jefferson City, bridges over Salem Creek, over creek, Sta. 11 plus 31, and over Three Rivers Creek, Ste. Genevieve Co., over overflow Little North Fork of White River, Ozark Co., and over Sac River Branch, Greene Co., to Garret Constr. Co., Springfield***over C. & A. R.R., Audrain and Boone Counties, to F. T. O'Dell Constr. Co., Hannibal. Bids Mar. 13. Noted Mar. 18, C. D. —Mar. 5, E. N.-R.

Mo., St. Louis—City, Bd. P. Serv., City Hall, fabricating and delivering 950 tons structural steel for work on South Valley Junction approach to bridge over Mississippi River, between here and East St. Louis, Ill., to Mississippi Valley Structural Steel Co., 3117 Big Bend Blvd., Maplewood, at $77.70 per ton, total **$73,815*****erecting, painting steel, to Ben Hur Erection Co., 510 Farlin Ave., $16.50 per ton, total **$15,675*****furnishing, delivering rail joint bars, rail joints, bolts, etc., Groups A, B, C, D, E, G and H, to Carnegie Illinois Steel Corp., 506 Olive St., St. Louis, Mo., and Carnegie Bldg., Pittsburgh, Pa., **$128,835*****Group F, to Woodrings-Verona Tool Wks., Verona, Pa., **$1,322*****Group I, to Ramapo-Ajax Corp., 301 South Main St., East St. Louis, Ill., **$17,-226.** Grand total $236,874. **P.W.A.** Bids Apr. 10. Noted Apr. 20, C. D.

New Jersey and Pennsylvania—L. Focht, engr., State Office Bldg., Trenton, N. J., constructing temporary support for steel tower of

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†Federal Government

Bridges, etc. (Continued)

suspension bridge between Reigelsville, N. J., and Riegelsville, Pa., to F. H. Clement & Co., Bethlehem, Pa., **$16,934.** Bids Apr. 14. Noted Apr. 9. C. D.

N. J., Belmar—Monmouth Co., constructing bridge over Shark River between Belmar and Avon, to Merritt Chapman & Scott, 17 Battery Pl., New York. **P.W.A.** Bids Apr. 8. Noted Apr. 14, C. D.—Apr. 16, E. N.-R.

New York—Dpt. P. Wks., Albany, 30 ft. and 50 ft. I-beam span and 65 ft. girder bridge on 0.49 mi. Oxford-McDonough Hy. 244 and Hy. 665, Chenango Co., to D. W. Winkelman Co., 205 Harrison St., Syracuse, **$109,887,** est. $128,114***105 ft. girder bridge on Chenango Forks-Whitney Pt., Parts 1 and 2, Broome Co., to Richard Hopkins Co., Box 1025, Albany, **$117,546,** est. $133,396***114 ft. girder bridge on Duanesburg-Esperance Rd., Schenectady Co., to Foley Bros., 135 East 42nd St., New York, **$132,029,** est. $144,691***30 and 50 ft. bridges on Dundee-Penn Yan Hy. 5324, Hammondsport-Dundee Rd., Part 4, Yates Co., to A. L. Blades, Hornell, **$37,756,** est. $48,662***20 ft. slab bridge on Homer Hy. 380, Cortland Co., to H. L. Bolton, **$9,818,** est. $12,575. Grand total $417,942. Noted Apr. 24, C. D.—Apr. 30, E. N.-R.

★ **New York—Lake Champlain Bridge Comn.,** Ticonderoga, N. Y., Contrs. 2 and 3, for bridge over Lake Champlain, between Rouses Point, N. Y., and Alburg, Vt., to Andrew Weston Co., Inc., Irving Pl., Woodmere, N. Y., **$422,429.** Est. $700,000. Approved by **P.W.A.** Noted Apr. 21 C. D.—Apr. 9, E. N.-R.

★ **New York — Triborough Bridge Authority, 111 8th Ave., New York,** esplanade and landscaping along East River Dr. from 92nd to 125th Sts., to Del Balso Constr. Co., 220 East 42nd St., New York, **$984,158*****landscaping between Legett Ave. and Hunts Point Rd., Bronx Connection, Contr. 65, to E. D. W. Milligan, Inc., 25 West 43rd St., New York, **$99,989,** both for Triborough Bridge, connecting Manhattan, Bronx and Queens Boros. Bids Apr. 9. Noted Apr. 10, C. D.—Mar. 19, E. N.-R.

N. Y., Gates—New York Central R.R. Co., J. W. Pfau, ch. engr., 466 Lexington Ave., New York, eliminating grade crossing by constructing bridge at Howard Rd., 25 mi. from Coldwater Station, to Walsh Constr. Co., 403 Herald Bldg., Syracuse. Est. $140,000. Noted Apr. 15, C. D.—Jan. 30, E. N.-R.

N. Y., Oneonta—City, City Hall, reconstructing rein.-con., steel bridges over Oneonta Creek to replace structures destroyed by flood, by relief labor. W.P.A. To exceed $23,000. F. M. Gurney, city engr. A. Calabrico, Telephone Bldg., Binghamton, porcurement officer W.P.A. will purchase materials.

North Dakota—State Hy. Comn., Bismarck, bridge in Eddy Co., to C. L. Lindberg, Jamestown, **$2,998*****overhead structure, grading, graveling, etc., in Barnes Co., to Gargo Bridge & Iron Co., Fargo, **$45,578*****overhead structure, grading, etc., in Ward Co., to A. A. Schultz, Minot, **$39,338.** Grand total $87,903. Bids Apr. 24. Rejected bids Apr. 24, bridges in Burleigh Co. Bids held up on pedestrian underpass in Mandan, Morton Co., pending conference with railroad engineers. Noted Apr. 3, C. D.—Apr. 9, E. N.-R.

Oklahoma—State Hy. Dpt., Oklahoma City, reflooring Lexington Bridge, on U. S. Hy. 77, Cleveland Co., $7,282; painting Washita River Bridge, Durant, Bryan Co., $1,908; reflooring present Norman Bridge over South Canadian River, at Norman, Cleveland Co., $14,593, by state forces. Grand total $23,783. V. T. Moon, Capitol, Oklahoma City, state engr.

Oklahoma—State Hy. Dpt., Oklahoma City, constructing 11 span 1,100 ft. concrete, steel bridge in Jackson Co., to Keliher Constr. Co., Thomas Bldg., Dallas, Tex., **$114,097** est. $136,224. Bids Apr. 21. Received no bids Apr. 21, constructing 43 ft. I-beam underpass in Bryan Co., $34,530. Noted Apr. 16, C. D.

Oregon—State Hy. Comn., Salem, constructing viaduct over Southern Pacific Ry., Milbrook Co., to Hoffman Constr. Co., Portland, **$410,212.** Bids Apr. 24. Noted Apr. 20, C. D.

Pennsylvania—At office W. Van Dyke, secy. Hys., Harrisburg, 3 span, plate girder bridge on Route 11, Kingston Boro, Butler Co., to Whittaker & Diehl, Calder Bldg., Harrisburg, **$68,469.** Bids Apr. 9. Noted Apr. 14, C. D.—Apr. 2, E. N.-R.

Pennsylvania—At office W. Van Dyke, secy. Hys., Harrisburg, plate girder and rein.-con. bridge, steel truss and plate girder bridge, etc., 1.35 mi. Route 444, Sect. 1, 37010, Spur "E," Mahoning Twp., Lawrence Co., to Holmes Constr. Co., Wooster, O., **$369,402.** Bids Apr. 3. Noted Apr. 8, C. D., under "Bridges and Grade Crossings," and Mar. 26, E. N.-R., under "Streets and Roads."

Virginia—See "Streets and Roads."

Washington—L. V. Murrow, dir. Hys., Olympia, constructing concrete, steel undercrossing tracks O. W. R. R. and N. Co. County Rd. on Darknell Rd. U. S. Wks. Project WPGS 281-A Spokane Co., to Triangle Constr. Co. 1220 Ide Ave., Spokane, **$16,687,** constructing 0.263 mi. steel, concrete and treated timber overcrossing County Rd. Railroad Overcrossing Black River Junction U. S. Wks. Project WPGS 244-C, Unit 1, King Co., to General Constr. Co., 3840 Iowa St., Seattle **$99,493.** Noted Apr. 7, C. D. —Apr. 9, E. N.-R., under "Streets and Roads."

Wyoming—See "Streets and Roads."

†Federal Government

STREETS AND ROADS

BIDS ASKED

†Alabama—May 13, by Tennessee Valley Authority, Knoxville, Tenn., constructing wearing surface on roads and streets of Nitrate Plant Reservations 1 and 2, near Wilson Dam, incl. 35,000 gal. prime coat, 35,000 sq.yd. 2 course surfacing, 49,000 sq.yd. single course surfacing, 52,000 sq.yd. surface treatment, 200 sq.yd. 2½ in. thick surfacing.

Arkansas—May 14, by State Comn., Little Rock, concrete paving, curbing, apron and platforms, graveling roads, earthwork, drainage around various buildings, Saline Co. $75,000. Mann, Wanger & King, Doneghy Bldg., Little Rock, engr.

California—May 21, by C. H. Purcell, state Hy. engr., 808 State Bldg., Los Angeles, concrete widening 9.8 mi. hy. from Seal Beach to Newport Beach, Orange Co., involving 48,000 cu.yd. earth excav., to exceed $23,000; grading, concrete paving 1.3 mi. State Hy. 2.2 mi. west of Indio, Riverside Co., 7,500 cu.yd. earth excav., to exceed $23,000; plant mix slow curing type paving 19.4 mi. hy. in San Bernardino and Riverside Counties, to exceed $23,000; grading, asphaltic concrete and concrete paving hy. within state hospital grounds, Camarillo, Ventura Co.; plant mix on bituminous macadam shoulders paving 6.8 mi. hy. between Castaic School and Piru Creek, Los Angeles Co.

Colo., Pueblo—See "Contracts Awarded."

Connecticut—May 11, by State Roads Comn., J. A. Macdonald, hy. comr., Hartford, water bound macadam paving 2,145 ft. Mountain Rd., Granby, state aid project; rolled bank run gravel surfacing 17,880 ft. Pine St., King, Johnson and Basket Shop Rds., Columbia, town aid project; 13,802 ft. Painter Ridge, River and Squire Rds., Roxbury; completion of Strongtown and Pierce Hollow Rds., Southbury, P.W.A. 7132; bituminous macadam paving 27,562 ft. Browns Hill, Cook Hill, Quigley and West Side Rds., Wallingford, P.W.A. 1241-B; sheet asphalt on concrete paving 6,114 ft. New Park Ave., West Hartford, P.W.A. 1176-B; twin 60 ft. pipe culvert and loose gravel surfacing 100 ft. Ranny Hill Rd., Roxbury; replacing wing walls box culvert over Shepaug River, Route 25, Washington; bridges, culverts on Durham-Higganum Rd., Haddam, both foregoing trunk line projects. To exceed $25,000.

Delaware—May 20, by State Hy. Dpt., Dover, surface treating 264 mi. hy., Contr. 487, involving 785,000 gal. seal asphalt, 108,000 gal. prime asphalt; Contr. 487-A, incl. 13,000 tons stone chips, New Castle Co.; Contr. 487-B, 16,500 tons stone chips, Kent and Sussex Counties.

Iowa—May 12, by State Hy. Comn., Ames, paving 0.511 mi. U. S. Rd. 63, WPGH 70-C, Mahaska Co., incl. 12,356 cu.yd. excav.; 0.175 mi. Primary Rd. 123, in Des Moines, Polk Co., 25,716 cu.yd. excav.; 1.868 mi. secondary road, south of Des Moines, WPSO 695-A, Polk Co., 13,006 cu.yd. excav.; 0.54 mi. U. S. Rd. 20, in Fort Dodge, WPMH 13-B, Webster Co., 3,601 cu.yd. excav.; grading 1.44 mi. secondary road from Backbone State Park east, WPSO 669-A, Delaware Co., 20,495 cu.yd. excav.; 0.331 mi. secondary road, between Sects. 14 and 15, Whitebreast Twp., Lucas Co., 43,550 cu.yd. excav.; 0.378 mi. secondary road northwest of Doon, G. N. Ry., Lyon Co., 60,540 cu.yd. excav.; 5.49 mi. secondary road, northwest of Coburg, WPSO 539-D, Montgomery Co., 104,204 cu.yd. excav.; 0.578 mi. secondary road, Sect. 28, WPGS 539-F, Montgomery Co., 76,916 cu.yd. excav.; graveling 1.44 mi. secondary road from Backbone State Park east, Delaware Co.; 6.954 mi. secondary road from Primary Rd. 48, east toward Bethesda, Page Co.; bituminous surfacing 19.484 mi. F.A.P. 408-ABCG, Primary Rd. 49, Cass and Montgomery Counties; 11.241 mi. Primary Rd. 25, from U. S. Rd. 6, to Guthrie Center, F.A.P. 337-AB, Guthrie Co.; 12.521 mi. U. S. Rd. 59, from Oakland to Avoca, F.A.P. 554-ABCD, Pottawattamie Co.; 2.617 mi. Primary Rd. 168, from Primary Rd. 7, north into Shelby, Pottawattamie and Shelby Counties. F. R. White, state hy. engr.

Ia., Allison—Butler Co., B. W. Hesalroad, aud., rejected bids Apr. 21, crushed rock surfacing 12 mi. and grading 48.25 mi. roads. O. W. Zack, co. engr. Noted Apr. 14, C.-D.-Apr. 16, E.N.-R.

Ia., Clinton—May 12, by Clinton Co., W. B. Gode, co. aud., grading, draining 9 mi. secondary road between Charlotte and Preston, incl. 157,900 cu.yd. excav. E. B. Lorenzen, co. engr.

Ia., Nevada—May 15, by Story Co., B. Dickey, aud., graveling 61.5 mi. roads. S. Stiegerwalt, co. engr.

Kansas—May 15, by State Hy. Comn. at Office of County Clerk, Anthony, earthwork, culverts, bridging, roadside improvement, sand clay surfacing, concrete paving 2.895 mi. hys. in Stafford, Reno, Harper and Edwards Counties.

Kansas—May 16, by State Hy. Comn. at office of County Clerk, Garnett, earthwork, culverts, bridging, light type surfacing, curbing, guttering, concrete paving 22.179 mi. hys. in Neosho, Montgomery, Cherokee and Anderson Counties.

Kansas—May 19, by State Hy. Comn. at office of County Clerk, Meade, light type surfacing, earthwork 9.971 mi. hy. Meade Co.

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Streets and Roads (Continued)

Kansas—May 20, by State Hy. Comn. at office of County Clerk, Cottonwood Falls, earthwork, culverts, bridging 0.557 mi. Project 13-2-WPGH 256 A, Chase Co.; extending bridge over Republican River, 1 mi. south of Clay Center, Project 15-19D-ERP 7, Clay Co.

Louisiana—May 13, by State Hy. Comn., Baton Rouge, widening, concrete paving 0.662 mi. DeSiard St., Monroe, Route 4, Project 1180, Ouachita Parish; concrete paving 5.738 mi. Lewis-Texas state line hy., Route 8, Project 1860, F.A.P. 192-A, Caddo Parish; 0.776 mi. hy. Donaldsonville, Route 168, P. 1181, Ascension Parish; grading, surfacing 5.2 mi. Church-Westport Hy. Route C-1414, Re.-Adv. (Bond F.R.) 1099, Rapides Parish; 3.6 mi. Chataignier North and Southwest Hy., Routes C-1446, 1144 and 1145, Re.-Adv. (Bond F.R.) 1165, Evangeline Parish; 5.4 mi. Intersection Route 262-Tynes Store Hy., Route C-1437, Re.-Adv. (Bond F.R.) 1154, Washington Parish; overpass and approaches 0.419 mi. Alexandria-Monroe Hy., Routes 5 and 14, P. 4953, WPGM 22 and 13, Rapides Parish; 0.453 mi. Covington-Pearl River Hy., Route 114, P. 6153, WPGS 335, St. Tammany Parish.

Maine—May 13, by State Hy. Comn., L. D. Barrows, ch. engr., Augusta, emulsified asphalt or penolithic type surfacing 0.48 mi. Project 139-E, Houlton; gravel surfacing 0.92 mi. Project 148-F, Mexico; 3.59 mi. Project 147-B, Topsham. Total est. exceeds $100,000.

Minnesota—May 15, by State Hy. Dpt., St. Paul, concrete paving 3.1 mi. State Project 1-35-38-2, F.A.P. 519, between 3 mi. west of Ely and Ely, incl. 60,806 cu.yd. excav.; 6.6 mi. S.P. 61-1-29-1, F.A.P. 282-B, between Baptism River and Beaver Bay, incl. 116,559 cu.yd. excav.; 13.4 mi. S.P. 75-6-40-1, F.A.P. 394-A, between 2 mi. north of Hendrum and Ada.

Minnesota—May 15, by State Hy. Dpt., St. Paul **(S.P. means State Project)**, paving 1.5 mi. West 7th St. from Tuscorara St. to Purnell Ave., S.P. 5-111-21, Division A, WPMH 754, incl. 8,533 cu.yd. excav.; 1.5 mi. West 7th St. from Purnell to Mississippi Aves., S.P. 5-111-21, Div. B, WPMH 754, 10,017 cu.yd. excav.; grading 3.2 mi. road between 1 mi. south of Spring Hill and Lake Henry, S.P. 4-4-55-3 A and B, WPSS 546-D, WPMS 546-E, 72,889 cu.yd. excav.; 4.2 mi. road between Afton Junction Trunk Hy. 12, S.P. 95-95-23-1 A and B, WPSS 549-A, 130,920 cu.yd. excav.; 0.9 mi. Lake Benton, S.P. 75-6-60-1, A, B and S.P. 14-7-41-3, WPMH 270-C and WPGM 270-B, 444-C, 107,848 cu.yd. excav.; 3.4 mi. road between 2 mi. southeast Pine River and Jenkins, S.P. 371-19-22-1 and 2, WPGH 373-C, WPGM 373-D, 74,144 cu.yd. excav.; 5.2 mi. road between State Aid Rds. 7 and 5, Project 21-01, WPSO 644-A, Douglas Co., 96,478 cu.yd. excav.; 7.8 mi. road between Cold Spring and 7 mi. N., Project 73-06, WPSO 717-A, WPMS 717-B, 105,767 cu.yd. excav.; 6 mi. road between Junction Trunk Hy. 1 and southwest to Sand Lake, Forestry Project 15A, National Recovery Project, Lake Co.

Miss., Clarksdale—See "Contracts Awarded."

New Jersey—May 18, by E. D. Sterner, Comr. State Hy. Dpt., Trenton, grading, rein.-con. paving 21,024 sq.yd. Route S-6 Sect. 1, Union Blvd., from D. L. & W. R.R. to Totowa Rd., Passaic Co., incl. 7,914 cu.yd. roadway unclassified excav.

N. J., Trenton—May 12, by P. Morton, city mgr., and Common Council, asphalt paving Sullivan Way; granite block paving South Stockton St.; vitr. brick paving East State St. $40,000. J. E. English, City Hall, engr.

New York—May 19, by A. W. Brandt, comr. Dpt. P. Wks., Albany, brick paving 0.79 mi. road in Cattaraugus Co.; concrete paving and 80 ft. girder bridge on 0.37 mi. Erie Co.; roadside improvement in Livingston and Ontario Counties; concrete paving 0.24 mi. Monroe Co.; graveling and concrete bridges on 2.09 mi. road in Stueben Co.; concrete paving 0.834 mi. Westchester Co.

N. Y., Lyons—See "Contracts Awarded."

Ohio—May 15, by J. J. Jaster, Jr., hy. dir., Columbus, roadside improvement 2.285 mi. part Broadview Heights Sect. part Brecksville Sect., Twinsburg-Elyria Rd., State Hy. 36, State Route 82, Cuyahoga Co., $8,197; 2.18 mi. Sect. E and part Sect. Cheviot Harrison Rd., State Hy. 42, U. S. Route 52, Hamilton Co., $9,665; 4.224 mi. Sects. F and G part Findlay Sect. Findlay-Kenton Rd., State Hy. 221, State Route 31, U. S. Route 68, Proposal 1, $9,858; 0.051 mi. Sect. F Findlay-Kenton Rd., State Hy. 221, U. S. Route 68, Proposal 2, $281, both Hancock Co.; 4.384 mi. Sect. Kent part Sect. D part Ravenna Sect. Kent-Ravenna Rd., State Hy. 323, State Route 5, Portage Co., $9,896; adjusting drainage structures, brick paving 0.384 mi. part Canton Sect. Akron-Canton Rd., State Hy. 66, State Route 8, U. S. Route 62, Stark Co., $30,389; grading, drainage structures, traffic bound paving Beach City to Dundee and Reese Rds., Tuscarawas Co., $15,211; widening existing concrete beam bridge with concrete beam construction from 29 ft. roadway plus one 5 ft. sidewalk to 44 ft. roadway plus two sidewalks over Ohio Canal, FA 204-16, State Hy. 470, State Route 204, Fairfield Co., $6,340.

O., Cleveland—May 12, by Bd. Comrs. Cuyahoga Co., improving Snowville Rd. $53,600. J. O. McWilliams, Standard Bldg., engr.

O., Fremont—See "Contracts Awarded."

Oklahoma—State Hy. Dpt., Oklahoma City, received no bids Apr. 21, grading, paving 7.04 mi. road in McIntosh Co., **$17,657**; grading, drainage 0.36 mi. McCurtain Co., **$5,95**[illegible] and 0.97 mi. Osage Co. V. T. Moon, state hy. engr. Noted Apr. 15, C. D.

Oklahoma—See "Contracts Awarded."

Tex., Gilmer—City is not taking bids for 7 in. rein.-con. paving, 2 in. asphalt top on grey base, curbing, gutters, 70,000 sq.yd. business and residential streets. $175,000. Bonds voted for same. P.W.A. application for grant pending in Washington, awaiting available funds. Hawley, Freese & Nichols, Capps Bldg., Fort Worth, engrs. (**Correction**—status of work.) Noted Apr. 10, C. D.—Apr. 16, E. N.-R.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, rejected bids Apr. 3, improving hy., Swanton, WPH 82-G. Will readvertise.

Wisconsin—May 15, by State Hy. Comn., Madison, crushed stone surfacing 6 mi. Lavalle-Cazenovia Rd., State Trunk Hy. 58, A.F.E. 56-32, Sauk Co.; gravel surfacing 9.8 mi. Black Earth-Mt. Horeb Rd., State Trunk Hy. 78, A.F.E. 13-36, Dane Co.; applying 34,000 gal. bituminous material for seal coat work, A.F.E. 23-22, Green Co.; 32,000 gal. material for skin mat work, A.F.E. 29-27, Juneau Co.

Wisconsin — May 12, by State Hy. Comn., Eau Claire, applying 126,000 gal. bituminous material for skin mat work, A.F.E. 46-32, 46-33, 46-34, Pepin Co.; 310,000 gal. A.F.E. 47-46, 47-47, 47-48, 47-49, Pierce Co.

Wis., Superior—May 15, by Hy. Comn. Douglas Co., Courthouse, bituminous surfacing 0.027 mi. County Trunk Hy. "K" (Rossister Ave.), P.W.C. Docket 988, Sect. 12; constructing Amnicon River Bridge, 35-47-13, two 24 ft. 7 in. timber, steel, concrete spans, County Trunk Hy. B, P.W.C. Docket 988, Sect. 33.

N. B., Fredenston — Provincial Govt. soon takes bids constructing 40 mi. Tobique to Miramichie Rd., 22 ft. front shoulder to shoulder. $400,000.

Ont., London—City Engineer Veitch, widening, concrete widening York St. for one block west of bridge. $25,000. Work will be done by engineers own staff.

CONTRACTS AWARDED

Alabama—State Hy. Comn., c/o G. Scott, pres., Montgomery, concrete paving and underpass 0.268 mi. hy. in York, WPGM 389-A, Sumter Co., to W. C. Howton Constr. Co., 3904 10th Ave. N., Birmingham, **$121,733**; roadside improvement 1.481 mi. Gadsden-Glencoe Rd., NRH 208-B, Etowah Co., to J. W. Gwin, Comer Bldg., Birmingham, **$24,429.** Bids Mar. 12. State Hy. Comn., c/o G. Scott, pres., Montgomery, rejected bids Mar. 12, beautification of 1.481 mi. Gadsden-Glencoe Rd., Etowah Co. Noted Mar. 23, C. D.—Mar. 5, E. N.-R.

†**Arizona** — **Pub. Rds., Phoenix,** placing crushed rock base course treated with asphaltic road material 9.141 mi. Route 8 Hermit Rest and Headquarters Service Roads and parking area, Grand Canyon Natl. Park, Coconino Co., to J. A. Casson, Phoenix, **$74,959.** Est. $69,993. Bids Mar. 19.

California—State Hy. Comn., P. Wks. Bldg., Sacramento, grading, asphaltic concrete paving 10.2 mi. hy. between Corning and Proberta, Tehama Co., to Peninsula Paving Co., 9 Main St., San Francisco, **$218,181*****grading, concrete paving, 0.3 mi. hy. between Folger Ave. underpass and 9th St. in city of Berkeley, Alameda Co., to L. C. Seidel, 4722 Market St., Oakland. **$28,730*****grading, applying penetration oil treatment on 6 mi. hy. between Juniper Creek and Alturas, Modoc Co., to Frederickson & Westbrook, P. O. Box 138, Lower Lake, **$28,408.** Grand total $275,319. Bids Apr. 22. Noted Apr. 30, C. D.

★ **California**—State Hy. Comn., P. Wks. Bldg., Sacramento, grading, roadway approach and roadway tunnel with Portland cement lining and pavement 0.3 mi. hy. between Sausalito and Golden Gate Bridge, Marin Co., to T. E. Connolly, 461 Market St., San Francisco, **$587,918**; grading, plant-mix on crusher run base surfacing 3.4 mi. hy. between Waldo Point and Golden Gate Bridge, Marin Co., to Macco Constr. Co., 815 Paramount Blvd., Clearwater, **$770,205.** Bids Apr. 15, awarded Apr. 23. Noted Apr. 24, C. D.—Apr. 9, E. N.-R.

Colorado—State Hy. Dpt., Denver, concrete paving 1.509 mi. hy. westerly from Denver City limits on State Hy. 2, F.A.P. 81-D, Jefferson Co., to Monarch Eng. Co., West Colfax Ave., Larimer St., Denver, **$126,605*****landscaping 0.523 mi. hy. westerly from La Junta on State Hy. 6, Otero Co., to A. L. Cook, Ottawa, Kan., **$5,408*****1.78 mi. hy. southerly from Pueblo on State Hy. 1, Pueblo Co., to Murphy, Knowlton & Eppick, Englewood, **$7,082.** Grand total $139,095. Bids Apr. 16, awarded Apr. 21. Noted Apr. 24, C. D.

Colo., Pueblo—City, G. W. Clark, clk., widening Santa Fe Ave. from 1st to 9th Ave., **W.P.A.** labor. $105,000.

Connecticut—State Hy. Dpt., J. A. Macdonald, state hy. comr., Hartford, bituminous macadam paving 807 ft. hy. Hamden, to C. W. Blakeslee & Sons, Inc., 58 Waverly St., New Haven, **$4,402*****waterbound macadam paving 12,042 ft. Durham, to D. Arrigoni, 605 Main St., Middletown, **$32,223*****6,424 ft. Crystal Lake Rd., Ellington, and 8,800 ft. Battle St., Somers, to L. Suzio Constr. Co., 98 State St., Meriden, **$40,559** and **$35,809** respectively***20,434 ft. Riverside and Botsford Hill Rds., Newton, to J. Varvello, Inc., 89 Park St., New Haven,

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†*Federal Government*

Streets and Roads (Continued)

$106,191. Grand total $219,484. Bids Mar. 30 (extended from Mar. 23). Noted Apr. 3, C. D.—Mar. 19, E. N.-R.

★ **Connecticut — At office J. A. Macdonald,** state hy. comr., Hartford, bituminous concrete paving 4,874 ft. hy. Putnam (award subject to filing bond), to M. A. Gammino Constr. Co., 728 Valley St., Providence, R. I., **$65,026** ***rein.-con. paving 24,666 ft. and bituminous macadam paving 665 ft. hy. Andover and Columbia, to Lane Constr. Co., 35 Colony St., Meriden, **$246,930*****concrete paving 2,424 ft. hy. Cromwell and Rocky Hill, and 9,517 ft. hy. Middletown and Cromwell, to D. V. Frione & Co., 36 Foxon St., New Haven, **$26,064** and **$61,912** respectively***8,030 ft. East Hampton, to A. I. Savin Constr. Co., 10 Village St., East Hartford, **$88,709*****all foregoing bids Mar. 16; rolled gravel surfacing 3,072 ft. Merritt Parkway Drives, Stamford, to P. Bacco, 1 Atlantic St., Stamford, **$15,142,** bids Apr. 20 (extended from Apr. 16). Grand total $503,813. Noted Mar. 23 and Apr. 9, C. D.—Apr. 9, E. N.-R.

Indiana—State Hy. Comn., Indianapolis, rock asphalt resurfacing 1.983 mi. road in Wabash Co., to N. B. Putnam, 206 Transfer St., Fort Wayne, **$37,744**. Est. $38,760. Bids Apr. 7, awarded Apr. 24. Noted Apr. 13, C. D.—Mar. 26, E. N.-R.

Indiana — State Hy. Comn., Indianapolis, graveling 4.323 mi. road in Perry Co., to Hart & Hart, Columbus, **$44,403.** Est. $50,669. Bids Dec. 17.

Kansas—State Hy. Comn., Chanute, to C. J. List Constr. Co., Railway Exchange Bldg., Kansas City, earthwork culvert 0.444 mi. P. 7-8 WPH 271-1, **$8,502;** 0.316 mi. P69-9 WPGS 477 D, **$39,860,** both Bourbon Co.; 0.517 mi. P59-6 WPGH 172 B, Labette and Neosho Counties, **$37,488*****to Scherrer & Bennett, Kansas City, 0.14 mi. 54-30 WPH 239-E **$1,261;** 0.537 mi. P.54-30 WPGH 239-E, **$50,831** both Greenwood Co.***to Stamey & Tidd, Hutchinson, 0.324 mi. P.54-30 WPH 239-F **$1,011;** 0.565 mi. P.54-30 WPGH 239-E, **$16,907** both Greenwood Co.***to Perry Constr. Co., Oberlin, 1.64 mi. P.59-6 WPH 172-E **$11,146;** and 0.461 mi. P.59-6 WPMH 172-D, **$31,627,** both Labette Co.,***to F. H. Freeto, Pittsburg, 0.606 mi. P.59-7 WPH 172-C, Neosho Co. **$7,773*****to M. W. Watson, Natl. Bank Topeka Bldg., Topeka, earthwork 0.283 mi. P.59-2 WPH 2A, **$1,496;** earthwork, culvert, curbing, guttering, 0.509 mi. P.59-2-WPMH 2A, **$9,917;** earthwork, culvert, concrete paving 0.612 mi. P.166-13-WPGH 126A, **$51,858** all foregoing Labette Co.***to Cook & Cone, Ottawa, light type surfacing 0.14 mi. P.54-30 WPH 239-E, **$210;** and 0.537 mi. P.54-30 WPGH 239-E, **$1,370** both Greenwood Co.***to N. L. Sherwood, Independence, 0.612 mi. P.166-13-WPGH 126-A, Labette Co. **$382.** Grand total $271,639. Bids Apr. 21. Rejected bids Apr. 21, earthwork, culvert, paving, curbing, guttering, 0.475 mi. P. 160-29 WPGM 198B, Montgomery Co. Noted Apr. 6, C. D.—Apr. 9, E. N.-R.

Kansas—State Hy. Comn., Olathe, to Scherrer & Bennett, Kansas City, earthwork, culverts 1.525 mi. P. 10-16-FA 3151, **$38,869;** 1.3 mi. P. 50-47-FA 3151, **$32,266;** 1.272 mi. P. 50-47A-FA 238E, **$53,102;** 0.741 mi. P. 10-17B-FA 238E, **$6,903,** all foregoing Johnson Co.*** to Blue Rapids Gravel Co., Blue Rapids, 8.516 mi. WPSO 532, **$81,359;** 0.175 mi. WPMS 532, **$607,** both in Osage Co.***to R. G. Aldridge, 1609 Nebraska Ave., Kansas City, earthwork 0.162 mi. WPGM 545, Wyandotte Co., **$10,645** ***to C. E. Gray, Emporia, earthwork, culvert, concrete paving 0.447 mi. P. 11-14B WPGM 430-D, Lyon Co., **$39,076*****to San Ore Constr. Co., McPherson, light type surfacing 0.175 mi. WPMS 532, **$280;** 8.516 mi. WPSO 532, **$13,597,** both in Osage Co.***to J. A. Tobin Constr. Co., 3700 Rainbow Blvd., Kansas City, earthwork, concrete paving 0.26 mi. P. 58-8 WPGM 526B, **$35,637;** 0.198 mi. P. 58-8 WPMH 526B, **$30,715,** both Wyandotte Co. Grand total $343,156. Bids Apr. 18. Rejected bids Apr. 18, light type surfacing 8.22 mi. WPSO 549 and 0.622 mi. WPMS 549, both Leavenworth Co.

★ **Kansas**—State Hy. Comn., Clay Center, earthwork, culvert 8.729 mi. WPSO 547, Chase Co., to M. Wunderlich, Jefferson City, Mo., **$222,132*****light type surfacing 8.729 mi. WPSO 547, Chase Co., to Cooke & Cone, Ottawa, **$13,269** ***earthwork, paving 0.362 mi. P. 4-ON 23-WPMH 385 E and earthwork, culvert, concrete paving 0.463 mi. P. 4-ON 23-WPGM 385 E, Clay Co., to D. L. Wheelock, Clay Center, **$18,024** and **$68,429** respectively***constructing viaduct P. 4-ON 23-WPGM 385 E, Clay Co., to Koss Constr. Co., Old Colonial Bldg., Des Moines, Ia., **$95,341.** Grand total $417,195. Bids Apr. 17. Rejected bids Apr. 17, bridge extension, Br. 10.3, 15-19 ERP 7, Clay Co. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

Kentucky—State Hy. Comn., Frankfort, concrete paving 1.398 mi. Brownsboro Rd., Louisville, Jefferson Co., to George M. Eady Co., Inc., 340 Byrne St., Louisville, **$123,799.** Bids Apr. 10. Noted Apr. 14, C. D.—Apr. 9, E. N.-R.

Kentucky—State Hy. Comn., Frankfort, grading, draining 4.562 mi. Petersburg-Anthoston Rd., Henderson Co., to Corum Bros., Madisonville, **$18,439*****bituminous Type 2 surfacing, waterbound macadam base, using MC-1 and RC-2 for surface mix, 0.614 mi. Main St., Nicholasville, Jessamine Co., to Kentucky Road Oiling Co., Frankfort, **$21,067.** Bids Apr. 17. State Hy. Comn., Frankfort, held in abeyance bids opened Apr. 17, for grading, draining 2.104 mi. Index-Louisa Rd., Martin Co.; surfacing 1.234 mi. Tennessee St. extension to old Mayfield Rd., Paducah, McCracken Co.; rejected bids Apr. 17, grading, draining 1.126 mi. Jackson-Booneville Rd., Owsley Co. Noted Apr. 23, C. D.—Apr. 9, E. N.-R.

Louisiana—State Hy. Comn., Baton Rouge, shell surfacing 33 mi. Marrero-Lafitte Hy., Routes 30, 1307 and 1235, Project 1173, Jefferson Parish, and gravel surfacing 6.326 mi. Darrow-Sorrento Hy., Route 761, Project 792-A-1, Ascension Parish, to Robinson & Young, Baton Rouge, **$24,862** and **$19,792** respectively ***concrete paving 2.876 mi. Kinder-Le Blanc Hy., Route 7, Project 1105-B, WPSS 293, Allen Parish, to Mills Engineering Constr. Co., Lake Charles, **$69,204*****grading, gravel surfacing 2.95 mi. Roselfield-Antioch School Rd., Project 1061, Route 1012, La Salle Parish, to Robinson & Wilde, Wildsville, **$21,804.** Grand total $135,661. Bids Apr. 15. Noted Apr. 23, C. D. —Apr. 2, E. N.-R.

Md., Baltimore—Bd. Awards, concrete paving 4,000 sq.yd. Contr. 124, to P. Averezza, 104 North Highland Ave., **$5,398*****4,225 sq.yd. Contr. 149, to Arundel Constr. Co., 910 Trinity St., **$6,943*****sheet asphalt paving 7,150 sq.yd. Contr. 664, to National Paving & Contg. Co., Menlo Dr. & W. M. R.R., **$32,313.** Grand total $44,654. Bureau Hys., Municipal Bldg., engr. Bids Apr. 15.

Massachusetts—Commonwealth of Massachusetts, Dpt. P. Wks., W. F. Callahan, comr., 100 Nashua St., Boston, Design 1, Type "E" bituminous concrete paving 20,810 sq.yd. bituminous macadam roadway base course, 4,235 sq.yd. sidewalk base course and 8,320 sq.yd. granite block pavement, Revere, to M. F. Gaddis, 6 Beacon St., Boston, **$128,069.** Bids Apr. 21, awarded Apr. 24. Noted Apr. 28, C. D.—Apr. 16, E. N.-R.

Mass., Boston — City, Dpt. P. Wks., C. J. Carven, comr., City Hall, bituminous resurfacing streets upon which there is no maintenance guaranty, during 1936, Dist. 1, to J. L. Pierce, 322 Gallivan Blvd., Dorcester, **$40,225;** Dist. 2, to Simpson Bros. Corp., 193 Hanover St., **$41,971.** Noted Apr. 23, C. D.

Mass., Newton—City, C. A. Mahoney, street comr., City Hall, concrete sidewalks, curbing, driveways various streets, to O'Malley & Delaney, 108 Elm St., Waltham, **$13,219;** coal tar sidewalks and driveways, to Hayes Estate, 22 Grant Place, Waltham, **$4,934.** Awarded Apr. 23. Noted Apr. 23, C. D.—Apr. 16, E. N.-R.

Michigan—State Hy. Dpt., Lansing, grading, drainage, concrete paving 2.146 mi. F50-6C-6, Macomb Co., to J. A. Mercier Co., 450 West Fort St., Detroit, **$71,548.** WPGS-X1 of 83-5-15-C-1, crossing tracks of Pennsylvania R.R. Wexford Co., having spill-through abutments, 2 structural steel bent piers, and two 30 ft. and one 40 ft. steel deck girder spans, to Frank & Stiehl, East Lansing, **$19,944.** Bids Apr. 9.

★ **Minnesota**—State Hy. Dpt., St. Paul, concrete paving 1.2 mi. State Project 91-91-22-1, WPMS 748-A, to McKenzie Bros., 440 Baker Bldg., Minneapolis, **$32,296*****grading 4.3 mi. S.P. 39-88-25-2 A and B, between Jasper and Ihlen, incl. 88,757 cu.yd. excav., to R. P. England, Sleepy Eye, **$39,914*****5.1 mi. S.P. 95-132-25-1B and S.P. 95-132-25-2, WPSS 536 A and D, between North Branch and point 9 mi. east, to J. W. Craig Co., 1814 California St. N.E., Minneapolis, **$28,771*****concrete paving 10 mi. State Project 61-3-24-1B and 2 F.A.P. 418 B and C, Lake City and Wabasha, 80,833 cu.yd. excav., to W. W. Magee, 118 West Central Ave., St. Paul, **$245,816*****6.9 mi. S.P. 75-6-31-2C, F.A.P. 343-B, between Doran and Breckenridge, to Okes Constr. Co., E-1501 1st Natl. Bank Bldg., St. Paul, **$234,192*****1.6 mi. S.P. 76-6-39-1C, 76-5-30 and 75-6-39-2D, F.A.P. 333 A and B, and 332 B and C, 10,784 cu.yd. excav., to Hallet Constr. Co., Crosby, **$57,706** ***4 mi. S.P. 75-6-57-2 and 75-6-57-1A, F.A.P. 163, between Luverne and point 4 mi. north, 47,272 cu.yd. excav., to Anderson & Sons, 100 North 7th St., Minneapolis, **$108,354*****grading 16.6 mi. S.P. 28-28-26-1 and 28-282-24, F.A.P. 240 and 200, between 3.5 mi. west of Beardsley and Graceville, 284,404 cu.yd. excav., to Hanson Bros., Wolverton, **$60,209*****6.7 mi. S.P. 59-17-30-2, F.A.P. 75, between Avoca and Fulda, 151,393 cu.yd. excav., to Duininck Bros., Prinsburg, **$32,298*****4.1 mi. S.P. 6-85-22-1, F.A.P. 523-D, southwest of Brewster and east Nobles County Line, 96,877 cu.yd. excav., to J. W. Craig Co., 1814 California St. N.E., Minneapolis, **$20,142.** Grand total $850,698. Bids Apr. 17. Noted Apr. 10, C. D.

Mississippi — E. D. Kenna, dir. State Hy. Comn., Jackson, to J. B. Sykes, Mendenhall, roadside improvement and beautification 1.08 mi. Jackson Battiesburg Hy., Simpson Co., **$839,** est $1,100*** to C. Weaver & Co., Inc., Jackson, grading, drainage structures, gravel surface course paving 2.272 mi. Woodville Natchez Hy., Wilkinson Co., **$31,869,** est. $33,000; 2.753 mi. same road, Adams Co., **$54,195,** est. $54,000 ***to Pigford Bros., Meridian, and Shuptrine Constr. Co., Clarksdale, grading, drainage structures, bridging, gravel surface course paving 4.588 mi. Boyle Merigold Hy., Bolivar Co., **$55,529,** est. $45,000***to Froemming Bros., Inc., 4384 North Green Bay Ave., Milwaukee, Wis., $2.558 mi. Smithville Tremont Hy., Itawamba Co., **$38,631,** est. $38,000***to S. B. Boyd, Columbia, and Newsom Bros., Columbia, 3.627 mi. Bruce Houlka Hy., Calhoun Co., **$64,176,** est. $63,000***to Rouse Constr. Co., Cape Girardeau, Mo., 2.433 mi. Shady Grove Friendship Hy., Attalla Co., **$26,244,** est. $29,000***

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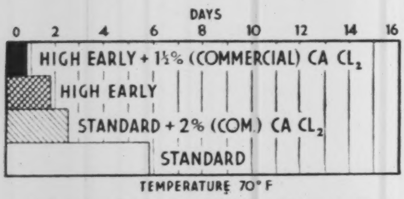

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Streets and Roads (Continued)

to S. K. Jones Constr. Co., Sterick Bldg., Memphis, Tenn., grading, drainage structures, bridging 0.568 mi. Starkville Columbus Co. Rd., Okitibbeha Co., **$46,788**, est. $43,000; grading, drainage structures 4.004 mi. same road, **$73,564**, est. $75,000. Grand total $391,835. **P.W.A.** Noted Apr. 8, C. D.—Apr. 16, E. N.-R.

Miss., Clarksdale—City, c/o R. Montgomery, comr., black top surfacing 20,000 sq.yd. 11 blocks city streets, W.P.A. labor. $23,000. W. S. Bobo, Clarksdale, engr.

Missouri—State Hy. Dpt., Jefferson City, to Garret Constr. Co., Springfield, grading and graveling 4.522 mi. Route T-Route 66, Greene Co., **$56,098**; 4.774 mi. in Ozark Co., **$45,247**; 4.247 mi. road in Ste. Genevieve Co., **$18,941*****to F. T. O'Dell Constr. Co., Hannibal, 0.447 mi. Audrain and Boone Counties, **$57,213.** Grand total $177,499. Bids Mar. 13. Noted Mar. 18, C. D.—Mar. 5, E. N.-R.

Nevada—State Hy. Comn., Carson City, surfacing and finishing new Geiger Grade Road, to Isbell Constr. Co., Reno, **$56,174.** Bids Apr. 23. Noted Apr. 14, C. D.—Apr. 16, E. N.-R.

New Jersey—E. D. Sterner, state hy. comr., Trenton, paving 0.4 mi. Route 25 near Newark Airport, to J. B. Gilligan-Casey Co., 972 Broad St., Newark, **$32,832.** Bids Apr. 20. Noted Apr. 27, C. D.—Apr. 30, E. N.-R.

N. J., Trenton—City Manager, to Union Paving Co., Broad and Stiles Sts., Phila., repaving Princeton Ave. **$47,404**; Ferry St. **$21,918**; Union St. **$16,704*****to Eastern Asphalt Co., Pennsylvania Bldg., Phila., repaving Allen St. **$6,725*****to Barrett Paving Co., 28 West State St., South Warren St. **$10,921*****to Agabiti Bros., 125 Swan St., Chauncey St. **$10,690.** Grand total $114,362. Noted Apr. 28, C. D.—Apr. 30, E. N.-R.

New Mexico—State Hy. Comn., Santa Fe, to Skousen Bros., Springer Bldg., Albuquerque, grading, drainage, structures, 2 course surfacing 5.465 mi. W.P.G.H. 27 **$93,270** est. $156,761; 3.412 mi. F.A.P. 27 reopened **$91,736** est. $168,500; 6.821 mi. F.A.P. 75 Reopened **$183,391** est. $133,647, all in McKinley Co.***to Davies & Sons, Fort Sumner, 0.856 mi. road in Elida Co. **$13,210** est. $21,013; 3.465 mi. Roosevelt Co. **$68,906** est. $77,374. Grand total $450,512. Bids Apr. 28. Noted Apr. 20, C. D.

New York—Dpt. P. Wks., Albany, concrete paving 6.11 mi. Livingston Co., to Rochester Vulcanite Paving Co., 340 Sherman St., Rochester, **$262,676** est. $322,804***0.4 mi. Cattaraugus Co., to A. K. Van Ingen, Hamburg, **$28,165** est. $37,365***6.93 mi. Livingston Co., to J. M. Murray, Cutler Bldg., Rochester, **$70,449.** Grand total $361,290. Bids Apr. 21. Rejected bids Apr. 21, improving 0.16 mi. Brewster-Carmel Hy. 909, Putnam Co. Noted Apr. 24, C. D.—Apr. 30, E. N.-R.

N. Y., Lyons—Wayne Co., reconstructing and repairing highways, own forces. $67,000. Owner will purchase sand, gravel, cement, bituminous materials. $67,000. L. Barnse, co. hy. engr.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., widening and repaving East 17th St., to Venetian Contg. Co., 2 Lafayette St., **$11,957*****curbing, flagging, asphalt paving Beak St., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., **$3,542*****granite block repaving, to S. B. Contracting Co., 139-156th St., **$17,783.** Grand total $33,282. Bids Apr. 21. Noted Apr. 22, C. D.—Apr. 16, E. N.-R.

★ **North Carolina**—State Hy. and P. Wks. Comn., Raleigh, **(P. means Project)**, to Kiker & Yount Reidsville bituminous surfacing 6.28 mi. P. 8273, Cleveland Co., **$24,108*****to C. G. Fuller, Barnwell, S. C., 9.06 mi. P. 2393, Johnston Co., **$39,342*****to R. B. Tyler Co., 1446 Levering St., Louisville, Ky., 3.57 mi. P. 1903, Tyrrell Co., **$13,640**; 4.49 mi. P. 505, Ashe Co., $20,795; 6.23 mi. P. 9404, Haywood Co., **$29,115*****to F. D. Cline, Raleigh, concrete paving, structures 4.17 mi. P. 1316 Gates Co., **$97,071**; concrete paving 0.93 mi. P. 2953, Wilson Co., **$11,424*****to L. S. Bradshaw, Salisbury, 0.24 mi. P. 6155, Cabarrus Co., **$19,566*****to Northeastern Constr. Co., Winston-Salem, asphalt on concrete surfacing structures 0.11 mi. P. 7440, Forsyth Co., **$24,441*****to Blythe Bros. Co., 424 South Brevard St., Charlotte, grading 3.93 mi. P. 9020, Buncombe Co., **$89,963*****to Reed & Abee, Inc., Asheville, structures same road, **$44,099*****to Hardaway Contg. Co., 15 11th St., Columbus, Ga., grading, traffic bound macadam surfacing 8.97 mi. P. 8681, Polk and Rutherford Counties, **$125,065**; grading, T. S. surfacing, artificial sand clay surfacing 13.06 mi. P. 6062, Anson Co., **$78,587*****to T. A. Loving, Goldsboro, structures on same road **$41,209*****to Wm. F. Bowe, Jr., 540 Reynolds St., Augusta, Ga., concrete paving 11.95 mi. P. 5681, Moore and Lee Counties, **$204,938*****to Bowers Constr. Co., Whiteville, structures 13.06 mi. P. 6062, Anson Co., **$23,779**; 0.4 mi. P. 1965, Washington Co., **$10,100*****to Welker Bros., Greensboro, grading traffic bound macadam surfacing 3.51 mi. P. 7560, **$45,230**; 1.69 mi. P. 7561, **$29,981**; both Stokes Co.***to Cobb & Homewood, Chapel Hill, structures on same road, **$6,590.** Grand total $979,043. Bids Apr. 15. Noted Apr. 23, C. D.

North Carolina—State Hy. Comn., Raleigh, concrete paving 0.154 mi. P. 1964, Washington Co., and bituminous concrete on concrete surfacing, structures 0.4 mi. P. 1965, both Washington Co., to C. Jones, Morehead City, **$6,601** and **$5,441** respectively***bituminous surface treating 5.39 mi. P. 5191, Davidson Co., to C. G. Fuller, Barnwell, S. C., **$19,402*****4.86 mi. P. 7803, Wilkes and Surry Counties, to R. B. Tyler, 1446 Levering St., Louisville, $22,575. Grand total $54,019. Bids Apr. 15. Noted Apr. 23, C. D.

North Dakota—State Hy. Comn., Bismarck, graveling 6.528 mi. road in Sioux Co., and landscaping 0.462 mi. in Minot, Ward Co., to Northwest Constr. Co., Bismarck, **$19,765** and **$6,052** respectively***graveling 8.006 mi. Foster Co., to Advance Constr. Co., Fargo, $9,203***grading 4.01 mi. and 2.92 mi. Eddy Co., to A. J. Jackson, Jamestown, **$12,887** and $24,159 respectively. Grand total $72,066. Bids Apr. 24. Rejected bids Apr. 24, improving roads in Slope, Nelson, Kidder and Stutsman Counties. Noted Apr. 9, C. D.—Apr. 16, E. N.-R.

O., Fremont—Sandusky Co., maintenance and repairing various hys., various materials, incl. bituminous brick and concrete, day labor, own forces. $121,482. J. R. Kuns, Fremont, co. engr.

Oklahoma—State Hy. Dpt., Oklahoma City, asphalt on gravel surfacing 7 mi. State Hy. 9, Kiowa Co., $66,822; seal top on 21.1 mi. State Hy. 74, Cleveland Co., $22,000; 5.5 mi. U. S. Hy. 62, Comanche Co., $2,621; graveling and oil paving 3.5 mi. U. S. Hy. 70, Choctaw Co., $5,505; 11.7 mi. U. S. Rd. 70, Choctaw Co., $30,155; 6.6 mi. U. S. Hy. 70, Bryan Co., $18,130, by state forces. Grand total $144,77[illegible].

Oklahoma—State Hy. Dpt., Oklahoma City, grading, drainage, graveling 1.73 mi. Willow Ave., Enid, Garfield Co., to Asplund Constr. Co., Enid, **$14,949** est. $15,674***3.61 mi. Creek Co., and 7.98 mi. Lincoln Co., to J. E. Smith & Sons, Noble, **$31,905** and **$38,515** respectively, est. $33,444 and $46,697 respectively***7.6 mi. Love Co., to Harrison & Harrison, Lindsay, **$21,444** est. $21,767***5.67 mi. Garbin Co., to Merveldt & Lawson, El Reno, **$23,830** est. $25,000***concrete paving 1.34 mi. Tulsa Co., to Ellis & Lewis, Muskogee, **$44,259** est. $50,652. Grand total $174,902. Bids Apr. 21. Noted Apr. 15, C. D.

Pennsylvania—At office W. Van Dyke, secy. Hys., Harrisburg, rein.con. paving rein.-con. arch. extension of existing rein.-con. culvert 3.4 mi. Route 238, Sect. 2, South Shenango Twp., Crawford Co., to Geo. S. Mellert-Weidener Co., Medina, O., **$119,736**; grading, drainage 1.01 mi. Route 66067, Fawn and Peach Bottom Twps., York Co., to Continental Constr. Co., 2508 North Charles St., Baltimore, Md., **$5,419.** Bids Apr. 17. Noted Apr. 23, C. D., under Streets and Roads, and Apr. 9, E. N.-R., under "Bridges and Grade Crossings."

Texas—G. Gilchrist, state hy. engr., Austin, grading, drainage structures, 4.314 mi. State Hy. "F," W.P.S.O. 932-A, Comanche Co., to Crouch & Noland, Strawn, **$47,280** est. $50,000***1.235 mi. State Hy. "F," W.P.S.O. 9350-A, Somervell Co., to J. F. Buckner, Cleburne, **$17,400** est. $20,000***grading, drainage structures, road oil on iron ore top soil base course paving 3.557 mi. State Hy. "F," W.P.S.O. 992-A, Camp Co., to H. L. Butler, 5219 Bradford Drive, Dallas, **$24,221** est. $20,000***grading, drainage structures, sledged conglomerate or caliche base course paving 5.167 mi. State Hy. "F," W.P.S.O. 868-A, Parker Co., to J. Floyd Malcolm & Co., Abilene, **$31,352** est. $30,000***double asphalt on gravel surface treating 6.297 mi. State Hy. "F," W.P.S.O. 871-A, Johnson Co., to J. E. Barnhill, Plainview, **$47,339** est. $50,000***grading, drainage structures, road oil and asphalt on iron ore surface treating 5.983 mi. State Hy. "F," W.P.S.O. 894-A, Cherokee Co., to A. L. Mays, Jasper, **$32,864** est. $35,000***grading, drainage structures, resectioning and lengthening drainage structures 8.807 mi. State Hy. 19, W.P.M.H. 370 A and B and W.P.H. 370 A and B, Montgomery Co., to McGinnis Co., Houston, **$93,529** est. $95,000. Grand total $293,985. Bids Mar. 25. New **P.W.A.** Noted Apr. 2, C.D.

★ **Texas**—G. Gilchrist, engr., State Hy. Dpt., Austin, grading, planting 0.261 mi. State Hy. 7, Coleman Co., to D. H. Buchanan, Temple, **$9,721** est. $10,000***grading, drainage structures 6.04 mi. State Hy. 40, Jefferson Co., to Brown & Root, Inc., 708 Colorado St., Austin, **$67,097** est. $70,000***14.446 mi. State Hy. "F," Newton Co., to H. Page Norwood Bldg., Austin, **$84,659** est. $80,000***widening concrete pavement, drainage structures 0.907 mi. State Hy. 26, Gregg Co.***grading, drainage structures, and metal base 7.97 mi. State Hy. "F," Ellis Co., to Austin Road Co., 1813 Clarence St., Dallas, **$64,449** and **$48,716** respectively est. $70,000 and $50,000 respectively***grading, drainage structures iron ore topsoil base course surfacing 4.98 mi. State Hy. "F," Morris Co., to H. L. Butler, 5219 Bradford Dr., Dallas, **$40,519** est. $40,000***grading, drainage structures, sand clay base course and gravel base course paving 5.802 mi. State Hy. "F," Cameron Co., to Dodds & Wedegartner, San Benito, **$44,986** est. $40,000***grading, drainage structures, gravel surface course 5.204 mi. State Hy. "F," Bastrop Co., to Holland Page, Norwood Bldg., Austin, **$30,828** est. $30,000***grading, drainage structures, iron ore base course and road oil and asphalt surface treating 5.975 mi. State "F," Van Zandt Co., to R. B. Smith, San Augustine, **$59,974** est. $65,000***grading, drainage structures, iron ore top soil base course paving 5.363 mi. State Hy. "F," Montgomery Co., to J. P. Foty, 3009 North Henderson St., Dallas, **$43,126** est. $40,000. Grand total $494,075. Bids Mar. 24 Noted Mar. 31, C.D. New **P.W.A.**

Texas—G. Gilchrist, state hy. engr., Austin, widening grading, drainage structures and gravel

Streets and Roads (Continued)

base, placing base preservative and seal coat on 4.818 mi. State Hy 2. Medina Co., to H. B. Zachry, Laredo, **$56,157** est. $60,000: grading. drainage structures, resectioning, reconditioning existing drainage structures 10.31 mi. State Hy. "F" Polk Co., to H. Page, Norwood Bldg., Austin, **$61,847** est. $65,000. New **P.W.A.** Bids Apr. 7. Noted Apr. 13, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, grading, drainage structures 6.999 mi. State Hy. "F" Comal Co. and grading, drainage structures, sledged stone base course 4.451 mi. State Hy. "F" Fannin Co., to James Spencer & Sons, Concan, **$73,291** and **$50,133** respectively. est. $80,000 and $50,000 respectively. Bids Apr. 8. New P.W.A. Noted Apr. 14, C. D.

Texas—G. Gilchrist, state hy. engr., Austin, resectioning drainage structures, planting, concrete paving 13.856 mi. State Hy. 36. F.A.P. 433-B and 465-B, reopened. Austin Co., to Harrison Eng. & Constr. Co., 903 Fairfax Bldg., Kansas City, Mo., **$264,447.** Est. $270,000. Bids Apr. 8. Noted Apr. 14, C. D.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, crushed stone mixed in place surface course with cutback asphalt and refined tar paving 0.8 mi. Route F-6, Project WPSO 194-A, Panton, to W. A. Collins, Stillwater, N. Y., **$29,540.** Bids Apr. 10, awarded Apr. 22. Noted Apr. 20, C. D.

Virginia—Dpt. Hys., Richmond, to C. D. & P. Fugate, Wise, improving 0.026 mi. roads Big Stone Gap, Big Stone Gap Co., **$7,146;** relocation at Blackwood, Wise Co., **$35,522;** 0.24 mi. Bluefield, Bluefield Co., **$8,033*****to Tidewater Constr. Co. Corp., Norfolk, 0.08 mi. and 0.19 mi. Jones Creek, incl. bridge, Isle of Wight Co., **$36,205*****to Echols Bros., Staunton, 0.27 mi. West Penn Laird, and bridge, **$36,804;** and 4.13 mi. Harrisonburg, **$106,876,** both Rockingham Co.***to P. L. Baird, Roanoke, 22nd St. and Ivy Ave., Buena Vista Co., **$5,161*****to M. Cain Co., Inc., 3315 8th St., Wash., D. C., 0.18 mi. and 0.099 mi. in Luray, **$2,647*****to E. P. Lindsay, Milner St., Nansemond Rd. and North Main St., in Suffolk, **$9,323;** Barnes Rd., Beech St. on Bainbridge Blvd., South Norfolk, **$4,836*****to Perkins-Barnes Constr. Co., Inc., Blackstone, 0.5 mi. and 0.3 mi. Blackstone, Nottoway Co., **$5,321*****to Battershill, Jones & Co., Virgilina, intersection Route 8 South Stuart, Patrick Co., **$25,114*****to R. L. Lambert, Richlands, Front St., in Richlands, **$32,298*****to Hall & Mitchell, Keswick, 0.019 mi. West intersection Main St., Charlottesville, **$5,996*****to Short & Thompson, Hopewell, 0.68 mi. SCL Culpeper, in Culpeper, **$4,249*****to G. P. Clay, Richmond, 4.5 mi. Lovingston, incl. bridge, Nelson Co., **$68,845;** 2.3 mi. intersection Route 15, Madison Co., **$53,755*****to R. Martin Co., Salem, 0.6 mi. and 0.2 mi. Rocky Mt., Franklin Co., **$7,744.** Grand total $426,832. Bids Apr. 21. Rejected bids Apr. 21, improving 0.22 mi. N. C1, Orange, WPMH 1045 M2, Orange Co., and Mallory St.: WPMS 1048 M2, in Phoebus.

Washington — L. V. Murrow, dir. Hys., Olympia, grading, concrete paving 2.251 mi. and constructing treated pile and timber trestle County Rd., Black River Junction to Renton, U. S. Wks. Project 244-A, WPMS 244-B, WPGH 244-C, Unit 2, King Co., to J. B. Covello, 1510 Storgus Ave., Seattle, **$159,718*****concrete and bituminous macadam paving 2.51 mi. State Rd. 9, City Streets, Hoquiam and Aberdeen, in Port Angeles U. S. Wks. Project WPMH 138 B, 166B, 54B, 54G, 54H, Clallam and Grays Harbor Counties, to Washington Asphalt Co., 309 West 39th St., Seattle **$51,870*****constructing treated timber and deck truss bridge 0.5 mi. County Rd. Morton Bear Canyon, U. S. Wks. Project WPSO 248-A, Lewis Co., to Hendricks & Co., Chehalis **$39,945.** Grand total $251,533. Bids Apr. 21. Rejected bids Apr. 21, grading, surfacing, asphaltic concrete paving 0.4 mi. and rein.-con. bridge City St., city of Walla Walla, U. S. Wks. Project WPMS 290A, Walla Walla Co., concrete paving 0.3 mi. and constructing rein.-con. steel approach spans State Rd. 3, Pasco Kennewick Bridge Revision, Franklin and Benton Counties, concrete paving 0.4 mi. State Rd. 21, Sixth St., city of Bremerton, Kitsap Co. Noted Apr. 7, C. D. Apr. 9, E. N.-R.

Wyoming—State Hy. Comn., Cheyenne, grading, draining, and constructing 3 treated timber bridges and 1 rein.-con. culvert 1.543 mi. Jackson Big Piney Rd., WPH 50, Sublette Co., incl. 83,500 cu.yd. excav. and grading, draining, base course surfacing, constructing 1 treated timber bridge, 1 rein.-con. culvert 4.72 mi. Garland Byron Rd. WPSO 279A Park Co., to Taggart Constr. Co., Cody, **$61,624** and **$82,294** respectively. Bids Apr. 23. Noted Apr. 14, C. D. —Apr. 16, E. N.-R.

EARTHWORK, IRRIGATION, DRAINAGE AND WATERWAYS

PROPOSED WORK

†N. Y., Irving—U. S. Eng., revised previous decision and ordered survey of proposed improvements to Cattaraugus Creek, Irving Harbor, Lake Erie. $250,000.

BIDS ASKED

†Florida—May 15, by U. S. Eng., Ocala, restoring earthen dike diversion canal, Oklawaha River Valley.

†Maryland—May 11, by U. S. Eng., Baltimore, placing layer of cape stone and building 1 manstone for cape stone on south face of North Jetty at Ocean City.

†New Jersey—May 25, by U. S. Eng., 2nd Dist., Whitehall St., New York, N. Y., dredging about 325,000 cu.yd. from Raritan River in south Amboy Channel between Great Beds Light and Central R.R. of New Jersey Bridge.

N. Y., Oneonta—See "Contracts Awarded."

Tex., Fort Worth—Tarrant Co. Water Control & Impvt. Dist. 1, c/o C. A. Hickman, taking bids earthen embankment, sodding, gate structures, rein.-con., reinforcing steel, clearing, sodding, 124,000 cu.yd. embankment, 200 ft. haul or less, 380,000 cu.yd. overhaul, 4,500 cu.yd. construction turnover, 17 acres Bermuda sodding. 2 gate structures. $50,000. Hawley & Freese, Capps Bldg., engrs.

B. C., Penticton—May 16, by City Council, completing Oliver Dam, part hydraulic and part dry fill. $50,000. A. R. MacLeave, City Hall, engr.

N. B. Escuminac—May 15, by Secretary Dpt. P. Wks., Ottawa, Ont., constructing breakwater extension, involving 101,000 cu.ft. square timber cribwork, 25,000 ft. B.M. creosoted sheathing, 12,000 lb. iron straps, tie-rods, etc. $34,000. K. M. Cameron, Ottawa, Ont., engr.

CONTRACTS AWARDED

Calif., Oakland—City Port Comn., constructing sheet steel pile bulkhead wall on Outer Harbor, west end of quay wall and inner end of oil pier, to Duncanson-Harrelson Co., De Young Bldg., San Francisco, oil pier $7,241, quay wall complete $3,535, total bid $10,776. Bids Apr. 13, awarded Apr. 22. Noted Apr. 20, C. D.

†Calif., Princeton—U. S. Eng., Post Office Bldg., Sacramento, setting back, raising, strengthening existing levee and constructing new levee along west side of Sacramento River from point opposite Wohlfrom Bend to ferry just north of Princeton, 7.5 mi., 433,000 cu. yd. earth excav., to R. L. Oakley & J. E. Immell, 801 South Grand Ave., Los Angeles, $106,461. Bids Apr. 21, awarded Apr. 24. Noted Apr. 27, C. D.

†Idaho-Oregon—Bureau Reclamation, Denver, Colo., earthwork and structures, North Canal laterals, near Ontario, Owyhee Project, to H. L. Horn, Nyssa, Ore., $8,818***on Owyhee laterals on beach southwest of Ontario, to G. B. Henly, Nyssa, Ore., $8,627***earthwork on North Canal, Mitchell Butte Div., to Fife & Co., Nyssa, $8,915. Grand total $26,360. Bids Jan. 7. Noted Mar. 13, C. D.

N. Y., New York—J. A. MacKenzie, comr. Docks, Pier A, North River, New York, dredging in slips adjacent to Piers 88 and 90, Contr. 2109, to Arundel Corp., foot Fulton St., Brooklyn, $72,695. Bids Apr. 9. Noted Apr. 19, C. D.

N. Y., Oneonta—City, City Hall, reconstructing culvert walls, bottoms and cover, incl. V shaped bed of concrete to be laid in bottom of creek, dam 400 ft. above Clinton St. catch basins, etc. for flood control by relief labor. $57,000. **W.P.A.** F. H. Gurney, city engr. A. Calabriso, Telephone Bldg., Binghamton, procurement officer W.P.A. will purchase materials.

Okla., Atlas—State Hy. Dpt., Oklahoma City, steel jetties for bank protection on Red River, to Kellner Jetty Corp., 415 East Gordon St., Topeka, Kan., $7,497. Est. $10,000. V. T. Moon, Capitol, Oklahoma City, engr.

Wash., Seattle—City, County City Bldg., constructing drainage system on Beacon Ave., to Queen City Constr. Co., 603 18th Ave. S. $72,444. Est. $62,311. Awarded Apr. 23. Noted Apr. 14, C. D.—Apr. 16, E. N.-R., under "Sewerage and Waste Disposal."

Que., Petite Riviere Est—Dpt. P. Wks., Ottawa, Ont., constructing fishing harbour, Gaspe Co., to Ludger Leniceuse, Ltd., $38,786. Est. $20,000. Noted Dec. 30, C. D.—Jan. 2, E. N.-R.

UNCLASSIFIED

PROPOSED WORK

★ **Ia., Vinton**—RURAL ELECTRIFICATION—Benton County Co-Operative Committee plans constructing 700 mi. transmission lines. Applied for $700,000 funds.

†Me., Winter Harbor—RADIO ANTENNA SUPPORTS—P. Wks. Officer, Navy Yard, Boston, Mass., rejected bids Apr. 23, antenna supports at Naval Radio Station, Spec. 8133. Noted Apr. 30, C. D.

Md., Frederick — AIRPLANE HANGAR — Mayor & Alderman, rejected bids constructing 1 story airplane hangar. Private plans.

Mich., Saginaw—AIRPORT—City Council instructed A. Cookingham, city mgr. to complete negotiations for the $35,000 W.P.A. airport at once.

Mo., St. Louis—DISTRIBUTION MAINS—St. Louis Refrigerating & Cold Storage Co., 1301 Lewis St., applied for permit to install distribution system in Washington Ave. from point 60 ft. east of 9th to 6th Sts., in 6th St. from Locust St. to Lucas Ave., and in St. Charles St. from point 30 ft. west of alley between 8th and 9th Sts. to connect with main in 9th St.

★ **Mo., St. Louis**—STREET LIGHTING SYSTEM—City, c/o B. L. Brown, pres., Bd. P. Serv., 304 City Hall, election Aug. 4, $650,000

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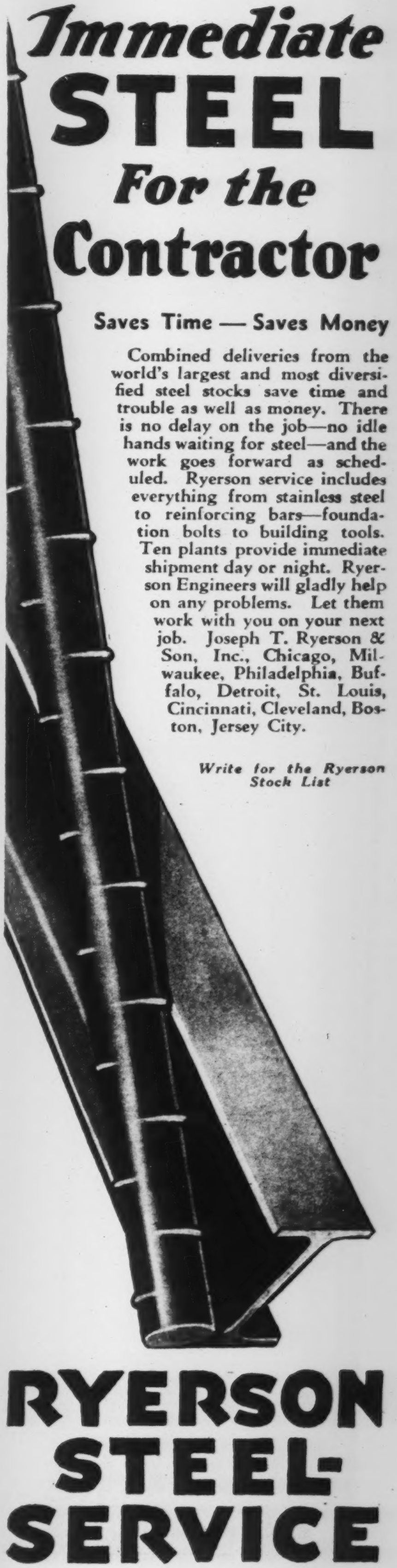
†Federal Government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Unclassified (Continued)

bonds for constructing 5,300 electric street lights, incl. standards, lanterns and glassware, bulbs and necessary cable, connections, transformers and sub-stations, etc. Wm. C. E. Becker, 301 City Hall, engr.

N. Y., New York—PLAYGROUNDS—Dpt. Parks, Arsenal Bldg., Central Park, plans constructing playgrounds and recreation building, 101st St. near 2nd Ave. To exceed $35,000. A. Embury, 2nd, c/o owner, archt.

N. Y., Port Washington—RADIO STATION—Pan American Airways Co., 135 East 42nd St., New York, plans constructing 100 watt radio station for transatlantic airmail route at Port Washington. To exceed $37,000. Maturity after July 1. Also plans radio station near Amagansett.

★ **Pa., Phila.**—HANGAR—City, Dpt. P. Wks., City Hall Annex, plans airplane hangar, Island Rd. and Tinicum Ave. $1,800,000. P.W.A. project.

R. I., Scituate—CAUSEWAY—City of Providence, C. A. Maguire, comr. P. Wks., S. F. Nolan, city engr., City Hall, preliminary plans reconstructing Ashland Causeway. $60,000. **Maturity indefinite.**

Tex., Harlingen—GRANDSTAND, etc.—See "Commercial Buildings."

BIDS ASKED

Minn., Moorhead — DAM — See "Contracts Awarded."

Mo., St. Louis—STEAM MAINS—May 22, by Bd. P. Serv., 208 City Hall, B. L. Brown, pres., constructing, installing extension to underground steam mains to supply Soldiers Memorial Building between 13th, 14th, Pine and Chestnut Sts. $52,000. P.W.A. project. Wm. C. E. Becker, 301 City Hall, engr.

N. Y., Brooklyn—BATHING PAVILION—See "Contracts Awarded."

N. Y., Brooklyn—PLAYGROUND—See "Contracts Awarded."

N. Y., Syracuse—RAILROAD—See "Contracts Awarded."

Pa., Allentown—AIRPORT IMPROVEMENTS—See "Contracts Awarded."

Pa., Meadville — AIRPORT — See "Contracts Awarded."

Tex., Brownsville — WHARF, MECHANICAL EQUIPMENT, etc.—May 15, by Brownsville Navigation Dist., c/o W. G. Willman, chn., furnishing mechanical, office equipment for wharves, sheds, offices, as follows: Schedule A, 1 crawler crane, approximately 80 hp. engine, cap fitted with 1 yd. clamshell bucket and electric magnet; Schedule B, 3 industrial gasoline tractors, fitted with water muffler and trailer hitch and equipped with rubber-tired wheels, each capable of hauling a train of 10 fully loaded trailers; 30 flat top warehouse trailers, with rubber-tired wheels, each 30 in. x 10 ft., 1 automatic dial platform scale, 48 x 48 in., capable of weighing up to 1,600 lbs.; Schedule C, office equipment consisting of 30 chairs, 3 tables, 8 desks, 2 filing cabinets, 2 stools, 3 hat racks, and 25 venetian blinds. P.W.A. project.

CONTRACTS AWARDED

Calif., Los Angeles—SCENE DOCK—Columbia Pictures Corp., 1438 North Gower St., 1 story, 135x250 ft., frame scene dock, concrete founds., composition flooring, asphalt paving, etc., 1438 North Gower St., to A. W. Peetz, 2231 Manning Ave., West Los Angeles. To exceed $37,500. G. C. Anderson, 1438 North Gower St., archt.

Kentucky and Indiana—PIPE LINE—Kentucky Natural Gas Corp., Owensboro, Ky., 24 mi. 12 in. multiflame Lindewelded pipe line between Terre Haute and Montezuma, Ind., connects present natural gas line from Owensboro, Ky., to Terre Haute, Ind., with Panhandle eastern main trunk line, to Connor & Sons Constr. Co., 1822 Main St., Kansas City, Mo.

La., New Orleans—MOORING PILE CLUSTERS—Texas Pipe Line Co., constructing 4 mooring pile clusters and frame pump house at Pilot Town, on Mississippi River, to J. Riess, Carondelet Bldg., $60,000. Private plans.

†Mass., Provincetown—LAUNCHWAY—Treas. Dpt., c/o Coast Guard Div., Custom House, Boston, reconditioning wood pile and timber launchway at Wood End Coast Guard Station, to M. M. Devine, Inc., 294 Washington St., Boston, Mass., $4,500. Awarded Apr. 24.

Minn., Moorhead—DAM—State and Clay Co., constructing Muksoda dam in north branch of Buffalo River to form artificial lake, 16 mi. east of here. **W.P.A.** labor. $50,000. State will furnish $15,000 and W.P.A. $35,000. Clay Co. voted to maintain dam after built.

N. Y., Brooklyn—BATHING PAVILION—Dpt. Parks, Arsenal Bldg., Central Park, New York, constructing 102x435 ft. bathing pavilion, day labor. $375,000. **W.P.A.** A. Embury, 2nd, c/o owner, archt.

N. Y., Brooklyn — PLAYGROUND — Dpt. Parks, Central Park, Arsenal Bldg., New York, constructing playground and drainage system, relief labor. $38,000. **W.P.A.** A. Embury, 2nd, c/o owner, archt. Owner is purchasing materials.

N. Y., Grand Island—PARK—Niagara Frontier State Parks Comn., State Office Bldg., Buffalo, constructing roadways, boathouses, boat harbor, sewers, drains, manholes, cesspools, also transplanting trees, grading and seeding for developing state park on Grand Island, relief labor. $290,000. Materials to be purchased by W.P.A. H. F. Lutz, state dir. Parks, State Bldg., Albany.

N. Y., Syracuse — RAILROAD — New York State Railways, 267 State St., Rochester, B. E. Tilton, pres., laying new trolley rails in Westcott St., Burnet, Midland and Irving Aves., and repairing pavement, own forces. $17[illegible]000. Owner will purchase materials.

Pa., Allentown—AIRPORT IMPROVEMENTS—Allentown-Bethlehem Airport Corp., c/o M. W. Gross, mayor, improving airport, incl. [illegible]30,000 cu.yd. earth excav., 3,820 ft. bituminous material runway, 2,570 ft. and 2,790 ft. slag runways and other improvements, day labor. $151,000. **Maturity at once.** W.P.A. project approved, also approved by U. S. Dpt. of Commerce. Noted Feb. 19, C. D.—Feb. 27, E. N.-R.

Pa., Meadville—AIRPORT—City, City Hall, R. L. Phillips, engr., constructing municipal airport at summit of Curry Hill, 2 mi. from town, incl. two 3,500 ft. runways, paved with bituminous materials, grading 60x80 ft. hangars, border, range and beacon lights, day labor under supervision of city engineer, est. $1[illegible]4,887. City soon takes bids for materials, incl. 3,267 cu.yd. crushed slag, 69,232 gal. road oil, 13,333 cu.yd. gravel, 4,760 ft. sewer pipe, [illegible]0,944 sq.yd. runway gravel, 45,211 sq.yd. bituminous materials, est. $11,043. Noted Mar. 19, C. D.—Mar. 26, E. N.-R.

Pa., Wellsville—GAS DEVELOPMENT—Wyoga Gas & Oil Corp., H. Fulton, company engr., 308 First Natl. Bank Bldg., Williamsport, developing new natural gas area in Willing and Amity Twps., Allegheny Co., southwest of here, drilling wells for same to G. H. Schrack, P. O. Box 625, Williamsport. Owner soon takes bids furnishing from 3,000 to 4,000 ft. 6¼ in. pipe for each well. Total est. $50,000.

Wash., Tacoma—POWER LINE—City Light Dpt., City Hall, ordinance before city council providing completion underground power line installation, central downtown district, to be carried out by day labor. $135,000. C. D. Forsbeck, City Hall, engr.

Ont., Toronto — PARK BUILDINGS — City Commissioner of Buildings, masonry for 1 story, brick, steel bandshell grand plaza exhibition park, to J. W. Hewitt & Sons, 56 Roncesvalles Ave., $16,250***carpentry, to C. W. Hurndall & Son, 85 Lombard St., $13,898***roofing and sheet metal, to Toronto Sheet Metal Wks., 36 D'Arcy St., $837***plumbing, to B. A. Robinson, 92 Blantyre Ave., $1,850***lathing and plastering, to J. Boyce, 479 Gladstone Ave., $616***electrical work, to Canadian Comstock Co., 80 King St. W., $4,626***painting, glazing, to Bavington Bros., 2032 Dundas St. W., $1,1[illegible]2. Grand total $39,239. Est. $50,000. Noted Apr. 17, C. D.—Apr. 23, E. N.-R.

MATERIALS AND EQUIPMENT

PROPOSED WORK

†STEEL REINFORCING BARS—**Fort Peck, Mont.**—U. S. Eng., 707 Postal Telegraph Bldg., Kansas City, Mo., rejected bids Apr. 30, 5,995,000 lb. steel reinforcing bars for Fort Peck Tunnel Outlet and Main Control Shafts for Fort Peck Dam. $90,000. Project will not be readvertised. Noted Apr. 21, C. D.—Apr. 23, E. N.-R.

PIPE, etc. — **Newport, N. Y.** — **Village** Bd. Trustees 7,500 ft. 4 in. c.i. pipe and connections for water supply. **To exceed $1,000.**

TELEGRAPH SYSTEM EQUIPMENT—**Rochester, N. Y.**—Dpt. P. Wks., City Hall, plans purchasing fire and police telegraph system equipment for proposed central fire building, North St. and University Ave. To exceed $20,000. Applied for P.W.A. funds. J. P. Flynn, Rochester, engr.

CARS and TRUCK — **Portland, Ore.** — City Council plans purchasing 26 cars and one truck for Police Bureau.

HYDRAULIC HOIST—**Portland, Ore.**—City Council soon takes bids hydraulic hoist.

METAL LATH, etc.—**Texas**—State, at office of J. W. Armstrong, Smith-Young Tower, soon takes bids supplying materials and equipment, f.o.b. designated points, incl. 450 pcs. metal lath, f.o.b. Sutherland Springs; 44,000 tons asphalt, f.o.b. Coleman; hundreds of door frames, window frames, building hardware, stair rail, etc., thousands of barrels of cement, 200,000 lb. structural steel, 2,000 fence posts, 5,000 lin.ft. 18 in. salt glazed vitr. clay sewer pipe, thousands of kegs, nails, various sizes, 150,000 ft. lumber, various sizes and classes.

TRANSFORMERS — **Tacoma, Wash.** — City Light Dpt., City Hall, plans furnishing transformers for installation in distribution system. $25,000. C. D. Forsbeck, City Hall, engr.

GENERATORS—**Edmonton, Alta**—A. Ritchie, supt. Municipal Power Plant interested in prices of 15,000 and 20,000 kwk. generators.

MOTOR PUMPER—**Amherst, N. S.**—Municipality votes $10,000, to purchase motor pumper. M. J. Kaufman, mayor.

STREET LAMPS — **Montreal, Que.** — See "Waterworks."

DIESEL ENGINE—**Regina, Sask.**—G. R. Dolan, principal, Balfour Technical School, interested in prices with view to purchase new Diesel engine.

†Federal Government

Materials, etc. (Continued)

BIDS ASKED

WATER PIPE—**Oakland, Calif.**—J. H. Kimball, secy. East Bay Municipal Utility Dist., 512 16th St., taking bids furnishing 5,000 ft. 8 in. diam. asbestos cement water pipe., Spec. LS-171.

TRAILER—**Hartford, Conn.**—May 12, by Bd. Contr. & Supply, at office of Mayor, furnishing, delivering 1 trailer for hauling road construction machinery.

†OXY-ACETYLENE PLANT EQUIPMENT—**Wash., D. C.**—May 14, by General Purchasing Officer, Wash., D. C., equipment for oxy-acetylene plant, incl. oxygen compressor, acetylene compressor, acetylene generators, electrolytic cells, insulating material and oxygen cylinders.

CORRUGATED CULVERT PIPE—**Clinton, Ia.**—May 12, by Clinton Co., W. Buell Gode, aud., 2,988 lin. ft. 15- to 42-in. corrugated culvert pipe. E. B. Lorenzen, Co. engr.

†AIR COMPRESSOR—**Boston, Mass.**—Yards & Docks, Navy Dpt., Wash., D. C., taking bids 1 steam driven air compressor, 5,000 cu. ft. per min. capacity to Boston Navy Yard, Spec. 8012.

TRUCK—**Detroit Lakes, Minn.**—Becker Co. in market for 1 truck for snow removal.

†MARINE OAKUM—**Vicksburg, Miss.**—May 29, by U. S. Eng., P. O. Box 667 furnishing 5,000 lb. unspun marine oakum, f.o.b. Vicksburg.

†YELLOW PINE LUMBER—**Vicksburg, Miss.**—May 29, by U. S. Eng., P. O. Box 667, 11,318 ft. B. M. lumber, f.o.b. Vicksburg.

PORTLAND CEMENT—**Albany, N. Y.**—Dpt. P. Wks., State Office Bldg., Albany, J. E. Sheary, in charge, taking bids 3,568 bbl. portland cement for highway maintenance, f.o.b. various destinations.

†WIRE—**Brooklyn, N. Y.**—May 11, by New York Signal Corps Procurement Dist., Army Base, 58th St. and 1st Ave., Brooklyn, 55,000 ft. wire, f.o.b. Brooklyn, and 5,000 ft. f.o.b. San Francisco, Calif.

TANKS—**Syracuse, N. Y.**—Standard Oil Co. of New York, Genesee Bldg., Buffalo, taking bids 1,000 gal. steel gasoline storage tank, for proposed service station, Midland and Corning Aves. To exceed $1,000.

PATROLS, etc.—**Bismarck, N. D.**—May 20, by State Hy. Dpt., Bismarck, 10 motor patrols, 5 crawler type tractors, 1 center line stripping machine, grader blades, $20,000; corrugated metal pipe culverts $3,000; rein.-con. pipe culverts, $3,000.

BRIDGE PLANK—**Lisbon, N. D.**—May 18, by J. L. Birklid, aud. Ransom Co., 1 carload of bridge plank, 3x12x18 ft. surfaced one side and edge.

CEMENT SIDEWALKS—**Cleveland, O.**—City. F. Milton, purch. agt., taking bids stone and cement sidewalks. $50,000.

PUMPS — **Enid, Okla.** — City, C. L. Lewis, engr., in market for six 250 g.p.m. deep well turbine type water pumps.

WATER PUMPS—**Oklahoma City, Okla.**—British American Oil Co., C. V. Sidwell, supt., in market for four 300 g.p.m. deep well water pumps and motors.

†GATES—**Casper, Wyo.**—May 26, by Bureau Reclamation, Denver, Colo., furnishing, delivering two 96 in. diam. ring-follower gates for installation in gate chamber of outlet works at Alcova Dam, Casper-Alcova Project. J. C. Page, Denver, Colo., acting comr.

VACUUM FILTER EQUIPMENT—**Winnipeg, Man.**—May 27 (extended date), by Administrative Bd. of Greater Winnipeg Sanitary Dist., vacuum filter equipment and accessories.

TRUCK—**St. Thomas, Ont.**—May 11, by G. F. Pinneo, road supt., Court House, supplying one heavy duty dump body gravel truck, 1½ to 3½ yd. capacity.

STEEL TANKS, etc.—**Quebec City, Que.**—Penco Oil Reg'd., M. Rabitaille, mgr., 124 Crown St., in market for two 1,000 gal. gasoline tanks and double pump.

CONTRACTS AWARDED

CAST IRON PIPE, etc.—**Anaheim, Calif.**—City Clerk, 2,800 lin.ft. 6 in., 2,200 ft. 4 in., 500 ft. 2 in. c.i. pipe, to U. S. Pipe & Fdry. Co., 417 South Hill St., Los Angeles, $2,104 ***5,780 lb. c.i. fittings, to Reliable Iron Fdry. Co., 1583 Fishburn St., Los Angeles, at 5c. per lb.***40 c.i. valve boxes, to Alhambra Fdry. Co., 1147 Meridian St., Alhambra, $4. Bids Mar. 24. Noted Apr. 3, C. D.

†PILE HAMMER, etc.—**Los Angeles, Calif.**—U. S. Eng., 751 South Figueroa St., one each pile hammer, double acting, to Garlinghouse Bros., 2416 East 16th St., $1.711***1 pile extractor, to Harrow, Rickard & McCone, 2205 Sante Fe Ave., $842. Bids Apr. 23. Awarded Apr. 24.

POLE or PIPE DOLLY—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt., Dpt. Water & Power, 207 South Bway., furnishing one four-wheel pole or pipe dolly complete, Spec. 1932, to Pike Auto & Trailer Wks., 2615 Santa Fe Ave., $1,350. To exceed bids Apr. 10, awarded Apr. 23. Noted Apr. 17, C. D.

FENCE—**Bridgeport, Conn.**—City, Dpt. Public Purchases, 172 State St., 1,900 ft. wire mesh fence with posts, to T. M. Barnes Co., 230 Stratford Ave., Bridgeport, $2,030. F. Toquet, City Hall, engr.

CLAY PIPE, etc.—**Princeton, Ill.**—City, F. N. Avery, mayor, 1,000 ft. 24 in. and 8,509 ft. 24 in. vitr. clay pipe, to Streator Drain Tile Co., Streator, $1.08 and $1.318½ per ft. respectively***127 bbl. Portland cement and 98 sacks Portland cement to C. A. Omen, Princeton, $2.65 per bbl. and 50c. per sack, f.o.b. yard***thirty-nine 24 in. c.i. rings and covers for manholes, $7.85 each, f.o.b. Princeton*** 39,000 No. 1 common brick for manholes, to Sheffield Shale Products Co., $13 per M*** 81 ft. 3 in. 14 ga. C.M.P., Sect. 68.1 A1, to W. Q. Neall Co., $1.79 per ft.***60 tons masons sand and 10 tons Class X gravel, to Western Sand & Gravel Co., $1.49 and $1.43 per ton respectively. Bids Mar. 23. Noted Mar. 19, C. D.

CONCRETE PIPE, etc.—**Muncie, Ind.**—City, concrete pipe for intercepting sewer to Independence Concrete Pipe Co. of Indianapolis, 201 North West St., Indianapolis, $115,862; vitreous pipe, to Armcie Clay Corp., Brazil, $1,508.

CEMENT, etc.—**Indianola, Ia.**—Warren Co., A. H. Traub, aud., cement, to Dalbey & Co., Norwalk, $274***to Erwin Lumber & Grain Co., Mils, $690***to Green Bay Lumber Co., Indianola, $1,233***to Iowa Lumber Co., Beech, $138***to Lacona Lumber Co., Lacona, $276 ***to Leachman Lumber Co., New Virginia, $1,656***to W. O. Sloan Lumber Co., Martensdale, $1,134***reinforcing steel and traffic treads, to Des Moines Steel Co., 7421 West 4th St., Des Moines, $1.165 and $573 respectively ***hardware, to Indianola Hardware, Indianola, $26***to McCoy-Spangler Hardware, Indianola, $269***lumber, to Green Bay Lumber Co., Indianola, $514***lumber and piling, to Wheeler Lumber Bridge & Supply Co., 606 Hubbell Bldg., Des Moines, $5,242 and $1,239 respectively***concrete pipe, to Iowa Concrete Products Co., Ames, $1.394. Grand total $15,823. Bids Apr. 23, awarded Apr. 23. Noted Apr. 20, C. D.

CEDAR POLES—**Detroit, Mich.**—City Public Lighting Comn., carload of eighty-five 40 ft. Western red cedar poles, to Westinghouse Supply Co., 882 Oakman Blvd., at $15.60 each, total $1,326.

GUARD RAIL, etc.—**Detroit, Mich.**—City, 200 gross tons of 140 lb., 25 gross tons 150 lb. guard rail, f.o.b. Detroit, to U. S. Steel Corp. Subsidiaries, Chicago, Ill., $15,964; six thousand 6x8 in. x 8 ft. No. 1 Cedar ties, to Michigan Pole & Tie Co., Detroit, $5.100.

STEEL RAILS—**Detroit, Mich.**—Pere Marquette, General Motors Bldg., H. A. Cassil, ch. engr., 1,500 tons rail, to Carnegie Illinois Steel Corp., Carnegie Bldg., Pittsburgh. Owner will lay rail by day labor and separate contracts.

WATERMAIN, SPECIALS, etc.—**Ada, Minn.**—City, 1,000 lin.ft. 4 in. and 700 lin.ft. 2 in. Class B mono cast or sand cast watermain, 500 lb. 4 in. and 100 lb. 2 in. specials, two 4 in. gate valves, and one 4 in. fire hydrant, to American Cast Iron Pipe Co., 941 Plymouth Bldg., Minneapolis, $1.010. Bids Apr. 14. Noted Apr. 9, C. D.

PATROL GRADER—**Luverne, Minn.**—Rock Co., R. Koehn, aud., power patrol grader, to J. D. Adams Co., Indianapolis, Ind. (Minneapolis office, 328 North 1st St.), $2.897. Noted Apr. 1, C. D.

TRUCK, etc.—**Madison, Minn.**—Lacqui Parle Co., 1 truck with 3 yd. dump body, to International Harvester Co., Watertown, S. D., $3.516; V-type snow plow for use with truck, to Northfield Iron Co., Northfield, $1.018. Noted Mar. 5, C. D.

HYDRANTS—**Minneapolis, Minn.**—City, F. S. Gram, purch. agt., to Mueller Co., Columbia Iron Wks. Div., Milwaukee, Wis., 6 in. gate valves for Water Dpt., $19.75 each; 8 in. at $30.50 each; 12 in. for $65 each; 16 in. $165 each; and 24 in. at $380 each; 40 hydrants $81.20 each. Bids Apr. 13. Noted Apr. 1, C. D.

PAVING MIXER—**Minneapolis, Minn.**—City, 1 paving mixer, to T. W. Rosholt Co., 3138 Snelling Ave., $9,922. Bids Apr. 8. Noted Apr. 1, C. D.

ROAD GRADERS—**Minneapolis, Minn.**—City, furnishing 2 motor road graders for Engineering Dpt., to W. H. Ziegler Co., 2331 University Ave. S.E., $2,210 each. Bids Apr. 9. Noted Apr. 1, C. D.

ROAD OIL—**Minneapolis, Minn.**—City, F. S. Gram, purch. agt., 2,100,000 gal. road oil, to Texas Co., 300 Baker Bldg., at 6.62c. per gal. Bids Apr. 16. Noted Apr. 9, C. D.

STREET SWEEPERS—**Minneapolis, Minn.**—City, 2 motor-powered street sweepers, one to Elgin Sweeper Co., Elgin, Ill., $6.790; and other to Austin-Western Mchy. Co., 2328 Territorial Rd., St. Paul, $6,790. Bids Apr. 17. Noted Apr. 9, C. D.

TRUCK CHASSIS, etc.—**Minneapolis, Minn.**—Hennepin Co., A. P. Erickson, aud., one 1½ ton dump truck chassis, to Pomeroy Chevrolet Co., 1664 Hennepin Ave., $635***1 power grader, to W. H. Ziegler Co., 2331 University Ave. S.E., $3.440. Bids Apr. 20. Noted Apr. 16, C. D.

DUMP TRUCKS—**Two Harbors, Minn.**—City, E. Carlson, city clk., furnishing one 1½ ton dump truck, to Arrowhead Garage, Two Harbors, $1.523; and one 1½ ton dump truck, to Elg Motors, Two Harbors, $1.384. Noted Mar. 26, C. D.

STRUCTURAL STEEL, etc.—**Jefferson City, Mo.**—State Hy. Comn., Jefferson City, 23,300 lb. structural steel, 9,580 lb. reinforcing steel, miscellaneous material for repairing bridge in

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†*Federal Government*

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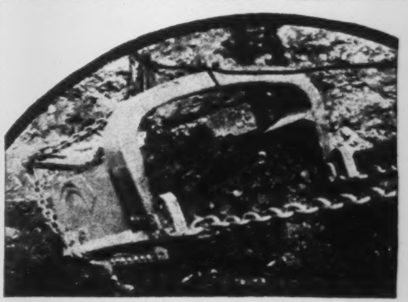

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Materials, etc. (Continued)

Franklin Co., to Tulley Equipment Co., 4215 Clayton St., St. Louis, $1,089. Bids Apr. 9. Noted Apr. 3, C. D.

LABORATORY EQUIPMENT—**St. Louis, Mo.**—Bd. P. Serv., City Hall, installing laboratory equipment in various buildings Homer G. Phillips City Hospital for Colored, Whittier and Kennerly Aves., to Hamilton Invincible Co., Two Rivers, Wis., $34,900. Est. $30,000. P.W.A. Noted Apr. 28, C. D.—Apr. 30, E. N.-R.

MOTOR GRADER—**Roundup, Mont.**—Musselshell Co., H. P. Bennett, aud., 1 motor grader, to Austin Western Road Mchy. Co., Billings, $4,746. Bids Mar. 3, awarded Apr. 18. Noted Feb. 24, C. D.

†FABRICATED PIPE and FITTINGS—**Boulder City, Nev.**—Bureau Reclamation, Denver, Colo., furnishing miscellaneous fabricated pipe and fittings for Boulder Dam Power Plant, to Associated Piping & Eng. Co., 1915 East 51st St., Los Angeles, Calif., $6,126. Bids Mar. 26. Noted Mar. 20, C. D.

CAST IRON PIPE, etc.—**Trenton, N. J.**—P. Morton, city mgr., and Council, supplies for waterworks, c.i. pipe, to U. S. Pipe & Fdry. Co., Burlington, $4,374; air compressor, to Swift Equipment Co., Phila., Pa., $3,490.

†PIPE — **Binghamton, N. Y.** — A. Calabriso, deputy procurement officer, Treas. Dpt., Telephone Bldg., Binghamton, 18 and 30 in. rein.-con. pipe, to Universal Concrete Pipe Co., Binghamton***17 and 24 in. rein.-con. pipe, to Earlville Concrete Pipe Co., Earlville***36 in. rein.-con. culvert pipe, to Better Concrete Products Co., Sherburn. Est. about $1,000.

CABLE—**New York, N. Y.**—Dpt. Purchase, Municipal Bldg., furnishing, delivering wire cable to Dpt. Plant & Structures, to Hazard Wire Rope Co., 230 Park Ave., $2,069. Bids Apr. 7.

AGGREGATE and BANK RUN GRAVEL, etc. —**Rochester, N. Y.**—Bd. Contr. & Supply, City Hall, A. Schreinder, purch. agt., 5,000 cu.yd. fine aggregate and 5,000 cu.yd. bank run gravel, to Charles Elam & Sons, at 88.5c. and 86c. per ton respectively; 8 ton roller, to Buffalo Springfield Roller Co., Brisbane Bldg., Buffalo, $4,045.

VITRIFIED TILE SEWER—**Utica, N. Y.**—Bd. Contr. & Supply, City Hall, 2,950 lin. ft. 15 in. double strength vitr. tile sewer pipe in 6 city streets to Everett Coakley Co., Herkimer, 66.6c. per lin. ft. Est. exceed $2,000. J. B. Shaw, city engr. Noted Mar. 13, C. D.—Mar. 19, E. N.-R.

CREOSOTED TIMBER PILES, etc.—**Raleigh, N. C.**—Div. Purchase & Contr., A. S. Brower, dir., 200 creosoted timber piles to Gulf States Creosoting Co., Charlotte, $2,418; 15,266 bd. ft. creosoted timber, to Georgia Creosoting Co., Brunswick, Ga., $920. Bids Apr. 28.

BRIDGE PLANK—**Grafton, N. D.**—Walsh Co., 1 car rough fir bridge plank, to Central Lumber Co., Grafton, $31.75 per 1,000***1 car bridge plank, to Robertson Lumber Co., Grafton $31.75***1 car bridge plank, to Wheeler Lumber & Bridge Supply Co., 600 Lumber Exch. Bldg., Minneapolis, Minn., $29.90. Bids Apr. 9.

MOTOR PATROL—**Grand Forks, N. D.**—Grand Forks Co., 1 motor patrol, to Lewis Tractor & Mchy. Co., Fargo, $3,597. Noted Mar. 26, C. D.

TRACTOR — **Hettinger, N. D.** — Adams Co., L. M. Lewell, aud., 1 track-type tractor, to Dakota Tractor & Equipment Co., Fargo, $6,650. Noted Mar. 20, C. D.—Mar. 26, E. N.-R.

MOTOR PATROL—**Mohall, N. D.**—Renville Co., W. A. Coutts, aud., furnishing 1 motor patrol to Northwestern Sheet & Iron Wks., Wahpeton, $4,793. Bids Apr. 10. Noted Mar. 26, C. D.—Apr. 2, E. N.-R.

TRACTOR and ELEVATING GRADER—**Valley City, N. D.**—Barnes Co., crawler type tractor and grader, to Dakota Tractor & Equipment Co., Fargo, $10,195; one 3 yd. capacity dirt remover for use with caterpillar, to Lewis Tractor & Mchy. Co., Fargo, $1,295. Bids Apr. 11. Noted Mar. 26, C. D.—Apr. 2, E. N.-R.

GRADER, etc. — **Washburn, N. D.** — J. L. Krebsbach, aud., McLean Co., elevator grader, to J. D. Adams Co., 328 North 1st St., Minneapolis, Minn., $4,391; two tractors, to Dakota Tractor & Equipment Co., Fargo, $8,803. Noted Mar. 26, C.D.

BITUMINOUS MATERIAL—**Harrisburg, Pa.** —Commonwealth of Pennsylvania, furnishing bituminous material, f.o.b. various points, for general maintenance patching, to York Valite Co., York, $3,746; and to Chambersburg Stone Co., Chambersburg, $3,040. Bids Mar. 20.

BITUMINOUS MATERIAL—**Harrisburg, Pa.** —Commonwealth of Pennsylvania, furnishing bituminous material, top course material, to General Crushed Stone Co., Fidelity Bldg., Phila., $4,806***to Bethlehem Steel Co., Broad St. Sta. Bldg., Phila., $2,810***and to Amiesite Corp. of Pa., Elverson Bldg., Phila., $2,467. Grand total $10,083. Bids Mar. 18.

BITUMINOUS MATERIAL—**Harrisburg, Pa.** —Commonwealth of Pennsylvania, furnishing bituminous material, to General Crushed Stone Co., Fidelity Bldg., Phila., $1,074***to Amiesite Corp. of Penna., Elverson Bldg., Phila., $537 ***to C. G. Goeringer Constr. Co., $744. Grand total $2,656. Bids Mar. 18.

BITUMINOUS MATERIAL—**Harrisburg, Pa.** —Commonwealth of Pennsylvania, furnishing bituminous material top course, f.o.b. various points, to Amiesite Corp. of Penna., Elverson Bldg., Phila., $2,205***to Interstate Amiesite Co., $4,214***to Barrett Co., Margaret and Bermuda Sts., Phila., $2,693***to J. and M. Doyle Co., 1519 Sansome St., Phila., $261. Grand total $9,372. Bids Mar. 17.

ASPHALT ROAD OIL, etc.—**Wilkes-Barre, Pa.** City, W. P. Johns, engr., 60,000 gal. road oil, to C. F. Goeringer Constr. Co., 296 Madison St., 6c. per gal.; 6 dump trucks for City Street Dpt., to Motor Twins, Inc., Wilkes-Barre. Bids Apr. 21. Noted Apr. 20, C. D.

RAILS — **Norfolk, Va.** — Seaboard Air Line R.R., W. L. Seddon, ch. consult. engr., 5,000 tons rails, to Tennessee Coal Iron & R.R. Co., Brown Marx Bldg., Birmingham, Ala.; 3,500 tons, to Bethlehem Steel Corp., Bethlehem, Pa.

WATER EQUIPMENT—**Seattle, Wash.**—City Water Dpt., County-City Bldg., furnishing water recording equipment at Water Dpt. Shop, to Shibley Co., Textile Tower, $9,014. Bids Apr. 16, awarded Apr. 23. Noted Apr. 13, C. D.

PUMPER, BOOSTER, etc.—**Spokane, Wash.** —City, City Hall, 750 gal. triple combination pumper, booster and hose wagon, to American LaFrance & Foamite Corp., 78 Jackson St., Seattle, $8,395***truck chassis, to Fageol Truck & Coach Co., 717 Dexter St., Seattle, $3,296 ***two No. 11 caterpillar Diesel auto patrols, single tandem drive, to Hfoius Ferris Equipment Co., 728 Mallon St., $10,128***1½ ton truck, with dump body and hoist, to Inland Chevrolet Sales Co., 1324 Second St., $1,078. Grand total $22,897.

†ASBESTOS FELT, etc.—**Madison, Wis.**—U. S. Treas. Dpt., Procurement Div., Madison, to Illinois Philip Carey Co., 2100 West Fullerton Ave., Chicago, Ill., 65 rolls asphalt sat. asbestos felt $2.07 per roll; 190 rolls at $2.925 per roll; 500 lb. roof coating at 2.26c. per lb.***to Standard Oil Co., Madison, 5,900 lb. asphalt roofing at $23.50 per C***to Consumers Supply Co., 4135 West State St., Milwaukee, 495 ft. 24- to 42-in. rein.-con. pipe $1,129; three hundred thirty-three concrete sewer ties $697; 7,099 ft. 8 and 10 in. sewer pipe $1,728; 3,288 ft. 12 in. sewer pipe $1,414; 3,247 ft. 15 in. sewer pipe $1,663***to Schneider Fuel & Supply Co., 3438 West Forest Ave., Milwaukee, 2,244 lin.ft. 15 in. concrete sewer pipe $1,663; 1,536 ft. 18 in. concrete sewer pipe $1,567; 2,044 ft. 15 in. sewer pipe $1,661*** to Milwaukee Plumbing, Heating & Supply Co., 715 West Clybourn St., Milwaukee, cast iron pipe $551***to Capitol Building Supply Co., 3522 North Fratney St., 200 bbl. Portland cement in paper bags $460, all for W.P.A. projects.

†GALVANIZED WIRE, etc.—**Milwaukee, Wis.** U. S. Forest Service, 9,106 lb. galvanized wire, to Indiana Steel & Wire Co., Muncie, Ind., $487***30,000 ft. common Douglas fir, to Jackson & Tindle, Munising, Mich., $573***pipe, to Cordes Supply Co., 441 North 2nd St., $1,687***7 back filling winches, to Shisser McLean Scraper Co., Sidney, O., $1,921***350 rolls snow fence, to Illinois Wire & Mfg. Co., Joliet, Ill., $710. Grand total $5,378. Awarded Apr. 22.

MILLWORK, HYDRANT VALVES, etc.—**Milwaukee, Wis.**—City, millwork, to A. Lentz Co., 1256 North 70th St., $410***hydrant valves, to N. L. Kulhn, 1055 North 4th St., $208***plumbing and heating supplies, to F. R. Dengel, 1134 North 4th St., $298***to Ellsworth Pipe & Supply Co., 1739 West St. Pearl Ave., $302***to Crane Co., 225 West Capital Dr., $541***and to Rundle Spence Mfg. Co., 445 North 4th St., $151. Grand total $1,910. Bids Apr. 16. Noted Apr. 14, C. D.

PIG LEAD—**Milwaukee, Wis.**—City, 10 tons pig lead, to National Lead Co., 1534 South 1st St., $4.99 per cwt., less 2%. Bids. Apr. 3, awarded Apr. 29. Noted Apr. 28, C. D.—Apr. 30, E. N.-R.

†PIPE, etc.—**Milwaukee, Wis.**—U. S. Forest Service, to Central Supply Co., 312 South 3rd St., Minneapolis, Minn., pipe and fittings $1,960; overhead irrigation system $1,146***to March Automatic Irrigation Co., Muskegon, Mich., 3,710 nozzles $36; 26 oscillators $368; 2,550 nozzles $25; 44 couplings $47***to White Showers, Inc., 6451 Dubois St., Detroit, Mich., 770 hangers $100; 563 hangers $73*** to Ellsworth Pipe & Supply Co., 1739 West St. Paul Ave., risers, valves $89***to Crane Co., 225 West Capitol Dr., 20 overhead irrigation lines $830. Grand total $4,674. Bids Apr. 1, awarded Apr. 20.

†PORTLAND CEMENT, etc.—**Milwaukee, Wis.** —U. S. Eng., 4,500 bbl. and 2,200 bbl. Portland cement, to Huron Portland Cement Co., 1325 Fort Bldg., Detroit, Mich., at $2.20 and $2.25 per bbl. respectively***3,800 tons sand and 6,300 tons stone, to Construction Aggregates Co., 33 North LaSalle St., Chicago, Ill., at 55c. and 65c. per ton respectively, total $6,240. Bids Apr. 20.

†SEWER PIPE, etc.—**Milwaukee, Wis.**—National Park Service, sewer pipe, to Schneider Fuel Supply Co., 3438 West Forest Home Ave., $665***lumber, to Hilty Forster Lumber Co., 3846 West Wisconsin Ave., $290***cement and lime, to Knoll Lumber & Fuel Co., Mellen, $180. Grand total $1,135. Bids Apr. 24.

LUMBER, etc. — **Neenah, Wis.** — City, to Lieber Lumber & Millwork Co., Neenah, 10 in. lumber, $1,905; 12 in. lumber, $2,015***to Home Fuel Co., 15 in. lumber, $349; vitr. brick, $954; sand, $110; cement, $180; limate, $75. Grand total $5,588. Bids Apr. 9.

ROAD OIL, ASPHALT CEMENT, etc.—**Kingston, Ont.**—City, supplying road oil, to Imperial Oil Ltd., foot of North St., [illegible] per gal.***castings, to Bishop Eng. Co., King St. E., $4.80 per 100 lb.***cement, to Drury Fuel & Builders Supplies, 235 Wellington St., $3.01 per bbl.***crushed limestone, to Frontenac Quarries Ltd., 126 Raglan Rd., $9.[illegible] and $7.20 per ton***limestone dust, to Windmill Paint Crushed Stone Co., Ridgeway, $[illegible] per ton***sand, to W. J. McKendry, R.R. 1, Glenburnie, 70c. per cu.yd.

STEEL RAILS — **Toronto, Ont.** — Toronto Transportation Comn., 57 Yonge St., supplying steel rails for track and roadside replacement program, to United States Steel Products Co. and Bethlehem Export Corp., both at Royal Bank Bldg., $40,000.

FOREIGN

Australia — F. S. Wright, 465 Collins St., **Melbourne,** in market for 6½ ton crane, [illegible] ft. gib, steam driven, air compressor, belt driven, about 200 cu.ft. force air per min. and 100 lb. with unloader, air receiver or receivers, totaling about 150 cu.ft. 100 lb. w.p. and accessories and engineering planing machine 12x4 or 5 ft. table, 4 to 5 ft. to bridge***July 27, by H. S. Wooton, acting city clk., **Melbourne,** supplying metering equipment***Sydney County Council, Queen Victoria Bldg., George St., **Sydney,** in market for two 8,600 kva. 3 phase, automatic transformers*****Bendigo** Municipality making plans water supply scheme, $500,000 voted*** **Castlemaine** Municipality making plans water supply scheme*****Brisbane** General Manager, Municipal Tramway and Power Development, River Rd., receives bids until **May 29,** supply of traction sub-station equipment, mercury arc rectifier, automatic control, gear d.c. switchgear, instruments, etc.***State Electric Comn. of Victoria, 32 William St., **Melbourne,** in market for vacuum and gas filled lamps, W. J. Price, secy. Quote unit prices.***Daniel Scott Pty., Ltd., 23 King St., **Melbourne,** making plans butter and creamery plant at Casterton ***A. Strang, Box 186, G.P.O., **Geelong,** in market for 10 hp. marine engine***General Manager Tramway & Power Department, Municipal Bldg., River Rd., **Brisbane,** supplying 2 steam generating units complete with superheaters, economics air heaters, draft plant, chain grate stoker, furnace, steam and feed pipes and necessary appliances.

Brazil, Sao Paulo—Pedro Gad, P. O. Box 979, interested in wood pulp, as also is A. Arensen, 21 Rua Benedictinos, Rio de Janeiro. Custom duty 94.039 milreis per gross ton.

Dominica, Santo Domingo—Benigno Perez Martinez, P. O. Box 216, interested in prices of calcium carbide. Custom duties per 100 kilos gross weight $2.

Egypt, Cairo—June 1, by Municipal Section Director, Ministry of Interior, supplying c.i. pipes 100 mm. and 150 mm. inside diam., steel valves, fittings Class C. Forms of tenders, specifications etc., at nearest Legation or Consulate General. Advisable to cable tenders followed up by mail.

England—H. Barney, archt., 33 Hugh St., **Croyden,** preparing plans extending Mayday Hospital, $500,000***City Engineer of Durham, plans housing development, **Framwellgate,** $600,000.

England—Harbor Supplies, Ltd., Lower Feversham St., **Middlesborough,** in market for supplying granite $2,500***Exeter Airport Ltd., **Exeter,** prepares plans aerodrome, Whitney W. Straight, Brattenham House, Strand, London, genl. mgr.***Ipswich Airport Ltd., **Ipswich,** making plans aerodrome, F. A. S. Swatkin, 34 Basinghall St., E.C. London, genl. mgr.

Holland, Soestdigk — Zoellners Agenturen, in market for supply chromium acid offers to be c.i.f. Rotterdam, to be packed in 100 lbs. lots or 50 kilo. drums.

India — Madras Government making plans constructing aerodrome at Meenambankum, $600,000***Mysore Government **Mysore,** making plans erecting civil aerodrome station at Jakkur, $1,000,000.

India, New Delhi—Standing Committee of Assembly on Railway Finance, voted for 1936-37, for constructing rolling stock Rs 3,18,00,000; new construction, Rs 24,00,000; and Hardinge Bridge Works, Rs 5,000,000.

New Zealand, Auckland—Auckland and Suburban Drainage Bd. plans by D. Holderness, constructing sewage scheme $6,800,000. Bids will be taken during summer for works involving $4,475,000.

New Zealand, Wellington—May 19, by Secretary P. Wks., Tenders Bd., supplying 1,000 volt switchgear and metering equipment*** June 15, by General Manager Railway Dpt., quantity of workshop machinery.

Northern Ireland, Belfast—Government making plans and takes bids in May extending police barracks, $500,000.

Russia, Moscow—Underground Ry., Moscow, 10 mi. subway extension, day labor. 910,000,000 rubles available for work. Owner will purchase materials.

Tasmania, Hobart—June 1, by Municipal Tramway Manager supplying 2 car sets of electric motors and controllers, air brake apparatus, etc.

South America — South American Gulf Oil Corp., Columbia, c/o Socony-Vacuum Oil Co., Inc., 26 Bway., New York, N. Y., and Texas Corp., 135 East 42nd St., New York, N. Y.

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†Federal Government

Foreign (Continued)

plans developing Barco oil concession in Columbia and constructing 250 mi. oil pipe line from concession to seaboard over mountain 4,000 ft. in altitude. $6,000,000.

PUBLIC BUILDINGS

PROPOSED WORK

Ill., Madison—Madison School Dist. 127, Madison Co., c/o Bd. Educ., received no bids Apr. 23, constructing high school and remodeling existing school, 3rd St. between Jackson and Washington Sts. M. Boulicault, 1101 Ambassador Bldg., St. Louis, Mo., and W. Wuellner, 2319 Central Ave., Alton, archts. Noted Apr. 20, C. D.

Mo., St. Louis—Bd. Educ., 911 Locust St., rejected bids furnishing, installing unaflow engines, generators, accessories, main light and power switchboard in Southwest High School at Kingshighway Blvd. and Arsenal St. $29,000. Plans to purchase electric current for school. G. W. Sanger, comr. School Buildings.

N. Y., Eaton—Central School Dist. 1 soon takes bids constructing school. $185,625. P.W.A. project. C. W. Clark, 27 North Main St., Cortland, archt. Noted Jan. 16, C. D.—Jan. 23, E. N.-R.

★ **N. Y., Greenburg**—Town of Greenburg, Tarrytown, plans brick, steel school, plain found., in Fairview Section. $516,000. Applied for P.W.A. funds.

★ **N. Y., Troy**—Bd. Educ., City Hall, plans by F. J. Morgan, 30 2nd St., 2 story, basement, 370x500 ft. school, Prospect Park. $1,430,000. Applied for P.W.A. funds. **Maturity in summer of 1936.** Noted Sept. 13, C. D.

N. D., Grand Forks—City, defeated proposal to sell bonds for financing electric power plant, distribution system, equipment, etc. and to approve contract conditionally awarded. Status now indefinite. Noted Mar. 26, C. D.—Apr. 2, E. N.-R., under "Contracts Awarded."

†Okla., Fort Sill—Con. Q. M., Fort Sill, rejected bids Apr. 13, altering and constructing additions to hospital Building 90. Noted Apr. 21, C. D.—April 2, E. N.-R.

★ **Pa., Williamsport**—City, L. Mussina, city engr., and Comrs. Lycoming Co., M. Krause, co. engr., plans by Simon & Simon, Fidelity Bldg., Phila., city-county building in heart of business district. Tentative plans provide for bus terminal to be located on ground floor. $1,000,000. May apply to R.F.C. for loan to finance construction of same.

★ **†China, Shanghai**—Treas. Dpt., P. Wks. Branch, Wash., D. C., making plans constructing consulate building. $750,000.

BIDS ASKED

†Arizona—May 18, by Bureau Reclamation, Dpt. Interior, constructing laboratory and combined warehouse, garage and 7 shop buildings, at Bartlett Dam, Salt River Project, Phoenix. Spec. 784d.

†Calif., Watsonville—June 12, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $135,000.

Conn., Middletown—May 14, by State, Lone Lane Farm, C. DeF. Penniman, supt., brick cold storage plant and dairy building at Lone Farm for Girls.

†Ga., Commerce—May 26, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $60,000.

†Ga., Monticello—May 27, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Agriculture and Post Office Building. $60,000.

†Ky., Louisville—May 21, by P. Wks. Administration, Housing Div., Wash., D. C., constructing superstructures College Court Housing Project, Project H-2503. Noted Apr. 20, C. D.—Apr. 23, E. N.-R.

Me., Machias—May 12, by State, Dr. B. E. Packard, state education comr., State House, rebuilding 3 story, basement, 124x124 ft., brick, steel, stone normal school at Washington State Normal School, destroyed by fire. Bunker & Savage, 256 Water St., Augusta, archts. Noted Feb. 24, C. D.—Feb. 27, E. N.-R.

Md., Rosewood—May 13, by Eiser & Aikers, mechanical engrs., 916 North Charles St., Baltimore, addition and mechanical changes to power house, Rosewood State Training School. H. P. Hopkins, 10 East Mulberry St., Baltimore, engr.

†Mass., Boston—May 25 (extended date), by P. Wks. Administration, Housing Div., Wash., D. C., constructing superstructures of Old Harbor Village Project H-3302. Noted Apr. 20, C. D.—Apr. 23, E. N.-R.

†Minn., Breckenridge—May 29, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $65,000.

Mo., Nevada—May 12, by State Hospital 3 and Bi-Partisan Bd. State Building Comn., E. A. Eagan, executive secy., Jefferson City, rein.-con., stone, steel boiler plant improvements at State Hospital. $190,000. Black & Veatch, 4706 Bway., Kansas City, engrs. Noted Apr. 20, C. D.—Apr. 23, E. N.-R.

†Mo., Richmond—June 1, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $64,000.

Mo., St. Louis—May 19, by City, Bd. P. Serv., City Hall, repairing and rehabilitation of 4 story, tower, basement, City Hall, incl. granite and cut stone work, new downspouts, sheet metal work, repairing tile roofs, slate roofs, repairing floors, carpenter work, plumbing, painting, concrete and brick work, glazing. $60,000. W. C. E. Becker, city engr.

★ **N. J., Jersey City**—May 19, by City, City Hall, altering and constructing additions to Medical Center. Total $4,545,454. P.W.A. project. J. T. Rowland, 30 Journal Square, archt.

N. Y., Altona—May 18, by Central Rural School Dist. 1, general contract (except foundations), plumbing, heating and electric for school. $216,363. P.W.A. project. Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

N. Y., Bemus Point—May 16, by Bd. Educ., Union Free School Dist. 4, general contract, plumbing, heating and electrical work for school. R. A. Freeburg, 1105 West 3rd St., archt. P.W.A. project. Noted Dec. 2, C. D.—Dec. 5, E. N.-R., under "Contracts Awarded."

N. Y., Bradford—May 11, by Bd. Educ. School Dist. 1, general contract, plumbing, heating, electrical work for brick, steel school, plain found. P.W.A. project. R. A. Freeburg, 1105 West 3rd St., Jamestown, archt. Noted Mar. 23, C.D.—Mar. 26, E. N.-R.

N. Y., Churchville—May 15, by Bd. Educ., Union Free School Dist., general contract, plumbing, heating, electrical work for school. $185,000. P.W.A. project. Bley & Yyman, 505 Delaware Ave., Buffalo, archts.

†N. Y., Huntington—May 28, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $120,000. Noted Sept. 11, C. D.—Sept. 19, E. N.-R.

N. Y., Ogdensburg—May 12, by Bd. Educ. F. Elie, chn. Building Com., general contract, heating, plumbing, electrical work for elementary and junior high school at Ogdensburg Free Academy, $377,000; general contract, plumbing, heating and electrical work for Trade School building, $170,400. P.W.A. project. Randall & Vedder, S. A. & K. Bldg., Syracuse, archts. Noted Mar. 16, C. D.—Mar. 19, E. N.-R., under "Contracts Awarded."

★ **N. Y., Stamford**—Bd. Educ. Central School Dist. 1, bids about May 15, general contract, plumbing, heating and electrical work for school, River St. $500,000. H. O. Fullerton, 152 Washington St., Albany, archt. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

†N. C., Burlington—May 28, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $185,000. Noted Jan. 29, C. D.—Feb. 6, E. N.-R.

†N. C., Marion—May 26, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $100,000. Noted Jan. 29, C. D.—Feb. 6, E. N.-R.

†O., Caldwell—May 29, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $65,000.

†O., Girard—May 28, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $68,000.

Pa., Dunmore—May 19, by Dunmore School Dist., F. G. Scott, secy., 30 room high school. $300,000. J. Howley, Scranton, archt. Noted Apr. 14, C. D.—Apr. 16, E. N.-R.

†Pa., Wayne—May 13 (extended date), by P. Wks. Administration, Div. Housing, Wash., D. C., superstructures of Highland Homes, Project H-9001. Noted Apr. 13, C. D.—Apr. 16, E. N.-R.

★ **R. I., Providence**—May 25, by Bd. Contr. & Supply, at office of Clerk of Committee's Department, City Hall, (1) general contract (2) heating (3) plumbing (4) electrical work (5) entire work complete for Senior Regional High School, 3 story, basement 242x287 ft., and 2 story, basement wing, brick, limestone trim, steel, rein.-con. found., Hope, Barnes, Brown and Olney Sts., P.W.A. Project 6579-B. **Total** est. $1,700,000. Mayor J. E. Dunne, ch. R. P. McElroy, city clk. I. S. Gorman, City Hall, city archt.; adv. E. N.-R. May 7.

†S. D., Mobridge—May 28, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $66,000.

†Tenn., Memphis—June 2, by P. Wks. Administration, Div. Housing, Wash., D. C., constructing superstructures of Dixie Homes Project, Project 3401. Noted Apr. 15, C. D.—Apr. 23, E. N.-R., under "Contracts Awarded."

†Tenn., Memphis—June 9, by P. Wks. Div. Housing, Wash., D. C., constructing superstructures Lauderdale Courts Housing Project H-3403.

†Tenn., Nashville—May 26, by P. Wks. Administration, Div. Housing, Wash., D. C., superstructures of Cheatham Place Housing Project, Project H-2101 and 2101 add. Noted Mar. 5, C. D.

†Tex., Big Springs—May 29, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $114,000. Noted Dec. 5, C. D.—Dec. 7, E. N.-R.

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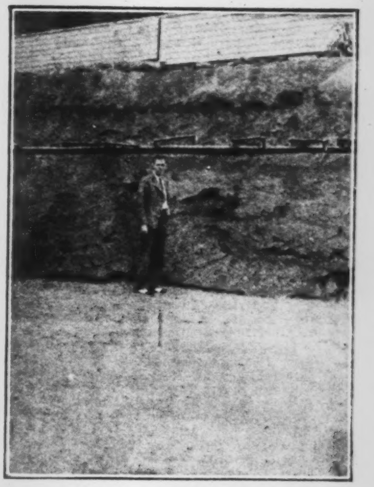
†Federal Government



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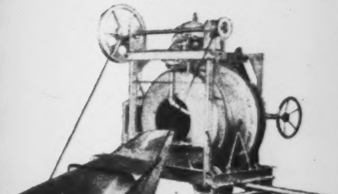

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Public Buildings (Continued)

Tex., Orange—May 26, by Orange Co., c/o R. L. Davis, judge, 3 story, about 64x150 ft., stone, steel, rein.-con. court house. $187,000. C. H. Page, Enfield-Gracy Bldg., Austin, archt. Noted Mar. 26, C. D.—Apr. 2, E. N.-R.

★ **Utah, Ogden—May 20, by Bd. Trustees Bd.** Educ., constructing **superstructure new high** school. **$750,000. P.W.A. project. Hodgson & McClehanan, Ogden, archt.**

†Va., Virginia Beach — May 26, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $80,000.

†Va., Yorktown—May 20, by Yards & Docks, Navy Dpt., Wash., D. C., repairing boilers at Naval Fuel Oil Station.

Wash., Pullman—May 15, by Bd. Regents, Davenport Hotel, Spokane, constructing 5 story, 160x168 ft. residence hall for women. $275,000. S. A. Smith, W. S. C., Pullman, archt.

†Wash., Seattle—May 21, by Treas. Dpt., at office Sup. Archt., Wash., D. C., repointing and waterproofing federal office building.

Wis., Manitowoc—May 14, by Public Utilities Comn., furnishing boiler feed pumps and drives, economizer induced draft fan, stack, refractory walls for 1,200 hp. steam boiler, concrete founds. and structural steel work for boiler, stoker, economizer, fan and boiler feed pump units.

†Wis., Park Falls—May 29, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $116,000.

†C. Z., Summit—Yards & Docks, Navy Dpt., Wash., D. C., taking bids constructing facilities building, 4 quarters, refrigerating system in barracks building and roads and walks at Naval Radio Station, Spec. 7890.

CONTRACTS AWARDED

Ark., Conway—Arkansas Teachers College, general contract constructing auditorium, commons building, physical education building, boys dormitory, presidents home, reconstructing science building, to Posey & Edwards, Monticello, $271,294***plumbing and heating equipment, to Gravier & Harper, Alexandria, La., $79,794***electric wiring and lighting equipment, to I. K. Electric Co., Little Rock, $19,794. Grand total, $370,882. Bids Apr. 29. **P.W.A.** Noted Apr. 22, C. D.

Calif., Camarillo—State Division of Architecture, P. Wks. Bldg., Sacramento, general contract 2 story, rein.-con. ward building, Units 6 and 7, State Hospital Grounds, to L. A. Geisler, 6212 Middleton St., Huntington Park, $192,830***heating and ventilating, to Yale-Riddell Co., 1826 South Main St., Los Angeles, $25,215***plumbing, to Scott Co., 243 Minna St., San Francisco, $19,197***electrical work, to Coast Electric Co., 2350 Cedar Ave., Long Beach, $11,039. Grand total $248,281. Bids Apr. 21, awarded Apr. 22. Noted Mar. 31, C D.—Apr. 9, E. N.-R.

Calif., Los Angeles—Bd. Educ., to Hoelzel-Ehmig Co., 1788 West 24th St., painting and miscellaneous work on South and North buildings at Palms School, 3520 Motor Ave., Palms Station, $1,498; on drafting bungalow at John C. Fermont High School, 7676 South San Pedro St., $114***to J. Ewins, 10385 Almayo Ave., on main and shop building at John Burroughs Junior High School, 600 South McCadden Pl., $1,365; on library building at Hollywood High School, 1521 North Highland Ave., $1,175; on men's physical education building at Los Angeles Junior College, $725. Grand total $4,877.

Calif., Los Angeles—Bd. Educ., Chamber of Commerce Bldg., 2 story, 64x220 ft. and 58x171 ft., rein.-con. administration building and home economics building at Virgil Junior High School, 152 North Vermont Ave., to Duff & Vandenhoogen, 733 West 14th St., Long Beach, $181,777. Bids Apr. 8, awarded Apr. 16. Noted Apr. 17, C. D.—Mar. 26, E. N.-R.

Calif., Los Angeles—Regents of University of California, Westwood, at Los Angeles, Library Bldg., 2 story, 75x175 ft., brick, steel, rein.-con. university building, to P. J. Walker Co., 3900 Whiteside Ave., Los Angeles, $188,010; electrical work, to Moore Electric Co., 321 West 3rd St., $29,736. Noted Apr. 20, C. D.—Apr. 9, E. N.-R. Bids Apr. 10, awarded Apr. 17.

★ **†Ill., Chicago** — P. Wks. Administration, Housing Div., Wash., D. C., constructing superstructure Jane Addams Housing Project, Project H-1405, to S. N. Nielsen Co., 3059 Augusta Blvd., $1,334,650. Bids Mar. 31. Noted Apr. 2, C. D.—Apr. 9, E. N.-R.

Ill., LaSalle—LaSalle-Peru Twp. High School Dist., J. Young, pres., general contract 3 story, 62x82 ft. high school addition, to Pere Anderson Co., Chicago, $315,000***plumbing also heating and ventilating, to Hynds Plumbing & Heating Co., LaSalle, $16,052 and $39,751 respectively***electrical wiring, to Kohl Electric Co., Green Bay, Wis., $11,996. Grand total $382,799. **P.W.A.** Bids Dec. 10. Noted Dec. 9, C. D.

†Ill., Marseilles—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to C. A. Moses Constr. Co., 176 West Adams St., Chicago, $48,649. Bids Apr. 14. Noted Apr. 16, C. D.—Mar. 19, E. N.-R.

†Ill., Vandalia—Dpt. P. Wks. & Bldgs., Div. Architecture & Eng., Springfield, general contract 5 buildings and hospital building, to J. J. Wuellner & Son, 101 Oak St., Alton, $193,907***heating and ventilating, to A. W. Murray Co., Hoopston, $25,600***plumbing, to J. P. Shields, 214 West Monroe St., Bloomington, $41,154***pipe covering, to W. J. Donahoe, 9 South Clinton St., Chicago, $4,970***sterilizing equipment, to Scanlan Morris Co., Madison, Wis., $2,000. Grand total $267,631. **P.W.A.** Bids Mar. 31. Noted Apr. 9, C. D.

†Ind., Evansville — P. Wks. Administration, Housing Div., Wash., D. C., constructing foundations for Lincoln Garden Housing Project, Project H-3901, to A. G. Ryan & Sons Constr. Co., Chrisney, $70,336. Noted Apr. 23, C. D.—Apr. 30, E. N.-R.

Ky., Madisonville—Hopkins Co., c/o County Clerk, 2 story, basement, 92x115 ft., brick, steel, concrete court house and jail, to **Ruby Lumber Co., Madisonville, $150,000. P.W.A. H. Lawrence Casher, Madisonville, archt.**

†Md., Cheltenham — Yards & Docks, Navy Dpt., Wash., D. C., constructing buildings at Naval Radio Receiving Station, to Doyle & Russell, Central Natl. Bank Bldg., Richmond, Va., $148,700. Bids Apr. 25. Noted Apr. 21, C. D.—Mar. 26, E. N.-R.

Md., Silver Spring—Bd. Educ. Montgomery Co., Court House, Rockville, 1 story, basement auditorium, gymnasium addition to Montgomery Blair High School, Silver Spring, to Morrison Bros., Bethesda, $119,990 est. $100,000; 1 story, basement auditorium addition to Sandy Springs High School, Sandy Springs, to T. Calvin Owens, Bethesda, $54,615 est. $60,000. **P.W.A.** Noted Apr. 3, C. D.—Apr. 9, E. N.-R.

Mass., Gardner—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, furnishing and installing sprinkler system at State Hospital, East Gardner, to Rockwood Sprinkler Co., 141 Milk St., Boston, $3,997***electrical signal system, to Connor Electric Corp., 12 Pearl St., Boston, $4,960. Bids Apr. 14. Noted Apr. 20, C. D.—Apr. 9, E. N.-R.

†Mass., Worcester—Treas. Dpt. at office Sup. Archt., Wash., D. C., reinforcing steel for parcel post building, to Concrete Steel Co., 294 Washington St., Boston***structural steel, to West End Iron Wks., 263 Columbia St., Cambridge***ornamental iron, to Ornamental Iron Wks., Akron, O.***limestone, to J. F. Carew, Inc., 11 Gerard St., Roxbury***heating and plumbing, to J. G. Lamotte & Son, Inc., 54 Commercial St., Worcester***granite, to J. Harrington Co., 52 First St., Cambridge***electrical work, to Friedman Electric Co., 137 Pearl St., Boston. Noted Apr. 13, C. D.—Apr. 16, E. N.-R., under "Contracts Awarded."

Minn., Austin—City, Bd. Water & Light Comrs., J. C. Todd, secy., general contract altering and constructing 1 story, 33x48 ft. power plant addition, to A. R. Robertson Co., 1603 University Ave., St. Paul, $198,000. **P.W.A. Bids Apr. 14. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.**

†Minn., Marshall—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Jensen Constr. Co., Natl. Bldg., Minneapolis, $50,211. Bids Apr. 17. Noted Apr. 21, C. D.—Mar. 26, E. N.-R.

Mo., St. Louis — Bd. P. Serv., City Hall, equipment for main kitchen, cafeteria, metabolic diet kitchen, ward diet kitchen, bakery equipment, ward dish washing equipment, electrical work, plumbing, steam piping, brine piping, etc., for Homer G. Phillips City Hospital for Colored, Whittier St., to Southern Equipment Co., 517 South 38th St., $78,750. **P.W.A.** Bids Mar. 25. Noted Apr. 1, C. D.—Feb. 27, E. N.-R.

Mo., St. Louis—City, Bd. P. Serv., City Hall, furnishing, erecting 4 cross-drum straight-tube boilers with brick settings in boiler room of City Sanitarium, Arsenal St. at Brannon Ave., to Heine Boiler Co., 5319 Shreve Ave., $98,042 est. $115,000***furnishing, erecting in place four forced-draft chain gate stokers, to Laclede Stoker Co., 4438 Hunt Ave., $19,732 est. $28,500***furnishing, erecting 1 coal conveyor system, to General Conveyor & Mfg. Co., 3601 Salena St., $37,096 est. $41,000. Grand total $154,870. **P.W.A.** Bids Apr. 10. Noted Apr. 20, C. D.—Apr. 2, E. N.-R.

†Mont., Missoula—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing annex and remodeling present post office, to A. D. Belanger & Co., 222 Westlake Ave., Seattle, Wash., $494,138. Bids Feb. 24. Noted Jan. 14, C. D.—Jan. 16, E. N.-R.

N. Y., Arkport—Union Free School Dist. 1, general contract constructing school, East Ave., to Sancke Bros., 80 Saranac St., Rochester. Est. $140,000. **P.W.A.** Bids Apr. 18. Heating for same, from M. J. Lippincott, 105 Canisteo St., Hornell, $21,394***plumbing, from McGinity-Johnson Co., 214 Prendergast St., Jamestown, $7,272***electrical work, from R. H. Carter Electric Co., Hornell, $10,550. Noted Apr. 24, C. D.—Apr. 30, E. N.-R.

★ **N. Y., Brooklyn**—Bd. Educ., 500 Park Ave., New York, constructing P. S. 239, Neptune Ave. and West 24th St., to H-R-H Constr. Co., 9 East 40th St., New York, $1,109,000. Former contract rescinded. Noted Feb. 10, C. D.—Dec. 13, E. N.-R., under "Contracts Awarded."

N. Y., Buffalo—C. H. Everitt, general contractor, 2095 Auburn Ave., metal lathing and plastering for county office building, West Eagle St., for Bd. Supervs. Erie Co., County Hall, to J. G. Davis Co., 80 Leslie St.***glass and glazing, to Pittsburgh Plate Glass Co., 101 Seneca St.***painting, to T. H. McElvein & Son, 263 Linwood Ave. **P.W.A.** Noted Jan. 24, C. D.—Jan. 30, E. N.-R., under "Contracts Awarded."

N. Y., Catskill—Bd. Educ. Union Free School Dist. 1, general contract high school, to C. B. Saxon, Inc., 35 West 45th St., New York, $353,000; heating, to James Hunter Heating & Contg. Co., 68 Liberty St., Albany***plumbing, to A. J. Eckert Co., Inc., 103 North Lake Ave., Albany***electrical work, to E. L. Bu[illegible] & Son, Cairo. Est. $353,000. **P.W.A.** Bids Apr 14. Noted Apr. 21, C. D.—Apr. 2, E. N.-R.

†N. Y., Ellis Island—Treas. Dpt. P. Wks. Branch, Wash., D. C., electrical work at immigration station, Ellis Island, to T. J. De-Kroney Co., 225 East 35th St., New York, $4,149.

N. Y., Goshen—Bd. Supervs. Orange Co., general contract county home, to Bowe Constr. Co., Inc., 44-72 11th St., Long Island City, $134,900***heating, plumbing and ventilating, to F. A. McBride Co., 327 Grand St., Paterson, N. J.***electrical work, to A. J. Strong, 91 Murray Ave., Goshen, $7,458***elevator, to Otis Elevator Co., 35 Market St., Poughkeepsie***sewage disposal plant, to Curtis & Harper, Inc., 490 Bway., Newburgh***refrigeration, to R. Y. Mathews, 117 North St., Middletown***food equipment, to Erschler & Krukin, Inc., 4933 Hudson Blvd., West New York, N. J.***laundry equipment, to Troy Laundry Machine Division, 100 5th Ave., New York. Est. $211,784. Bids Apr. 15. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

N. Y., Hinsdale—Bd. Educ., general contract school, Olean Rd., to Liechti & Mallory, 426 York St., Olean. Est. $140,000. **P.W.A.** Rejected bids for plumbing and heating. A. W. E. Schoenberg, 211 1st Natl. Bank Bldg., Olean, archt.

N. Y., Jamestown—Bd. Educ., general contract school, Cole Ave., to Hass Constr. Co., 10th and Monroe Sts., $152,080***heating and ventilating, to McGinity Johnson Co., 212 Prendergast Ave., $21,663***electrical work, to Linquest Electric Co., North Main St., $11,131***plumbing, to L. Marsh, Jamestown, $7,783. Grand total $192,657. **P.W.A.** Bids Apr. 20. Noted Apr. 22, C. D.—Apr. 16, E. N.-R.

N. Y., Jefferson—Central School Dist. 1, general contract school, to Nelson Constr. Co., 647 Draper Ave., Schenectady. Total est. $140,000. **P.W.A.** Noted Apr. 28, C. D.—Apr 30, E. N.-R.

N. Y., Johnson City—Bd. Educ., R. E. Loder, pres., general contract school, Roberts St., to F. W. O'Connell, Water St., Binghamton $199,338***electrical work, to M. M. Gleason, Binghamton, $11,800***heating and ventilating also plumbing to S. P. Ainslie, Johnson City, $32,967 and $10,457 respectively. Grand total $254,562. Bids Apr. 9. Noted Apr. 15, C. D.—Apr. 9, E. N.-R.

N. Y., Limestone—Union Free School Dist. 1, general contract school, Carrolton Rd., to A. Link Sons, 616 North Goodman St., Rochester, $92,950***heating and plumbing, to F. C. Patterson, 76 Mechanic St., Bradford, Pa., $15,800 and $63,000 respectively***electrical work, to Gabler Electric Co., 116 South 4th St., Olean, $9,300. Grand total $181,050. **P.W.A.** Noted Apr. 2, C. D.—Apr. 23, E. N.-R.

N. Y., Saranac Lake — Union Free School Dist. 1, Harrietstown, general contract school, Petrova Ave., to L. F. Murtagh, 121 Webster St., Malone***heating, to Carson Bros., 15 Woodruff St., Saranac Lake***electrical work, to Saranac Auto Parts Co., Bloomingdale Ave. Est. $100,000. **P.W.A.** W. G. Distin, 84 Main St., archt. Noted Apr. 27, C. D.—Apr. 30, E. N.-R.

N. Y., Spencer—Central School Dist. 1, general contract school, to J. M. Knowlton Co., Inc., 201 Robinson St., Binghamton***plumbing, to S. P. Ainslie, 83 Glenwood Ave., Binghamton***heating, to Fred Bradt Co., Inc., 515 Oakwood Ave., Syracuse***electrical work, to M. M. Gleason, 239 Water St., Binghamton. General contractor awarded contract for reinforcing steel and steel joists, to Bethlehem Steel Corp., Bethlehem, Pa. Total est. $155,144. **P.W.A.** Noted Apr. 27, C. D.—Apr. 30, E. N.-R.

N. Y., St. Regis Falls—Central Rural School Dist. 1, Dickinson, general contract school, to John Duffin Co., Water St., Malone***heating and plumbing, to Hanna & Porter, Inc., 15 West Main St., Malone***electrical work, to Bowker Electric Co., 141 Webster St., Malone. **P.W.A.** Noted Apr. 21, C. D.—Apr. 23, E. N.-R.

S. D., Vermillion—City, furnishing, installing, connecting one 1,000 hp. Diesel engine driven electric generating unit in municipal power plant, to Worthington Pump & Machine Corp., 1012 Pioneer Bldg., St. Paul, Minn., $52,247. Noted Mar. 5, C. D.—Mar. 12, E. N.-R.

†Tenn., Memphis—P. Wks. Administration, Div. Housing, Wash., D. C., constructing foundations for Lauderdale Court Housing Project, Project H-3404, to S. & W. Constr. Co., 983 Shrine Bldg., $204,371. Bids Apr. 7. Noted Apr. 14, C. D.—Mar. 19, E. N.-R.

†Tenn., Nashville—P. Wks. Administration, Housing Div., Wash., D. C., constructing foundations for Andrew Jackson Courts Housing Project, Project H-2102, to Bush Building Co., 805 8th Ave. N., $103,264. Bids Apr. 15. Noted Apr. 24, C. D.—Apr. 2, E. N.-R.

Tex., Anahuac — Chambers Co., c/o G. C. Jackson, Jr., judge, general contract and painting 3 story, part basement, 75x150 ft., fireproof court house building, to R. E. McKee, P. O. Box 217, El Paso, $189,900***plumbing, to Port Arthur Plumbing Co., Port Arthur, $9,750***electrical work, to Neches Electric Co., Beaumont, $8,589***heating and air conditioning, to Dixie Heating & Ventilating Co., 109 Fannin St., Houston, $25,500. Grand total $333,739. **P.W.A.** Bids Apr. 22. Noted Apr. 10, C. D.—Apr. 16, E. N.-R.

†Federal Government

Public Buildings (Continued)

†Tex., Denton—North Texas State Teachers College, c/o Dr. W. J. McConnell, pres., superstructure 2 story, basement, 144x204 ft. library, to A. J. Rife Constr. Co., 1913 North Harwood St., Dallas, $190,055***cast stone, to Dallas Architectural Decorating Co., Dallas***structural steel, to Panhandle Steel Co., Wichita Falls***plumbing, to D. C. Downes, Capps Bldg., Fort Worth. **P.W.A.**

†Tex., Fort Sam Houston—Con. Q.M., constructing utilities shops and garage to R. E. McKee, 1918 Texas St., El Paso, $30,300. Bids Apr. 15. Noted Apr. 28, C. D.—Mar. 26, E. N.-R.

Utah, Price—Carbon Co. School Dist., furnishing, installing plumbing and heating systems in new Price School, to Parley Larsen, Provo, $12,972***plumbing and heating in Helper School, to Henry Hall, Helper, $7,457. **P.W.A.** Bids Apr. 18. Noted Apr. 9, C. D.

†Va., Fredericksburg — Treas. Dpt. at office Sup. Archt., Wash., D. C., extending U. S. Post Office, to Lundberg Richter Co., Liberal, Kan., $96,490. Bids Apr. 14. Noted Apr. 16, C. D. —Mar. 19, E. N.-R.

Wash., Pullman—Washington State College, general contract constructing women's gymnasium, to Howard Eng. Corp., 1331 Third Ave., Seattle, $301,203***plumbing, to Advance Plumbing & Heating Co., 1531 Pacific St., Tacoma $15,891***heating, to University Plumbing & Heating Co., 3939 University Way, Seattle, $45,429***wiring, to Wire Electric Co., 3580 South Tacoma Ave. $13,842. Grand total $376,365. Subject to **P.W.A.** approval. Noted Mar. 10, C. D.—Mar. 12, E. N.-R.

†W. Va., Bluefield—Treas. Dpt. at office Sup. Archt., Wash., D. C., air conditioning and alterations to U. S. Post Office, to F. H. Martell Co., Rockville, Md., $24,400. Bids Mar. 16. Noted Mar. 19, C. D.—Feb. 27, E. N.-R.

†Virgin Islands, St. Thomas—Yards & Docks, Navy Dpt., Wash., D. C., improving power facilities in connection with aviation facilities, to Atlas Imperial Engine Co., 120 North 14th St., Mattoon, Ill., $20,350. Bids Apr. 15. Noted Apr. 21, C. D.—Mar. 19, E. N.-R.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., San Francisco—A. Haas, c/o H. C. Baumann, archt., 251 Kearny St., making plans 9 story, steel frame and concrete hotel addition, Turk and Mason Sts. $150,000.

N. Y., Brooklyn—Ridge Colonial Corp., 102 Flatbush Ave., plans by S. Malkind, 105 Court St., constructing group 2 story dwellings, Dahlgren Pl. $140,000.

N. Y., Brooklyn—Hawthorne Street Corp., 550 Flatbush Ave., plans by B. W. Dorfman, 56 Court St., 6 story apartment, 45 Hawthorne St. $165,000.

N. Y., Brooklyn—Ministers & Missionaries Benefit Bd. Northern Baptist Convention, 152 Madison Ave., plans by J. M. Berlinger, 17 East 49th St., New York, altering heating, plumbing in group 3 story tenements, 149 East 45th St. $40,000 with fixtures.

N. Y., New York—Alpark Realty Corp., 4375 Bway., plans by I. L. Crausman, 332 East 149th St., 6 story apartment, 201st St. and Decatur Ave. $150,000.

N. Y., New York—Corporation, c/o M. Kleban, 90 East 164th St., plans 6 story apartment, Gerard Ave near 153rd St. To exceed $200,000, site acquired.

N. Y., New York—Longchamps Restaurants, 624 Madison Ave., constructing restaurant addition, incl. air conditioning system, 1019 Madison Ave., site purchased.

N. Y., New York—Madison Equities, Inc., S. Glass, 161 East 178th St., plans 6 story apartment, 161 East 178th St. $150,000 or more. Site acquired.

N. Y., New York—Sam Ray Realty Co., c/o S. Derbner, 161 East Gun Hill Rd., plans by I. L. Crausman, 332 East 149th St., 6 story apartment, Dekalb Ave. and 212th St. $150,000.

★ **N. Y., New York**—St. Lukes Home for Aged Women, Bway. and 114th St., plans constructing home, Amsterdam Ave. and 111th St. To exceed $1,000,000. **Maturify later.** Site acquired.

★ **N. Y., New York**—Trinity Church Corp., 74 Trinity Pl., plans by E. J. Kahn, 2 Park Ave., constructing office building modernization, 253 Bway. $1,000,000.

N. Y., Niagara Falls—St. John de LaSalle Church and School, 8469 Buffalo Ave., plans by W. A. Cannon, 2637 Main St., repairing and replacing 2 story, basement school and church, destroyed by fire. **Maturity later.** Noted Mar. 19, C. D.—Mar. 26, E. N.-R.

N. Y., Rego Park—Happy Homes, Inc., 37-53 90th St., Elmhurst, plans group brick dwellings, Alderton St. and 63rd Dr. $140,000. Private plans.

N. Y., Rochester—Sibley, Lindsey & Curr, 228 East Main St., plans altering building for installing 4 escalators, plumbing, electrical work, painting for building. J. F. Warren, 130 East Main St., engr.

Okla., Oklahoma City—S. K. Shields, Hightower Bldg., making final plans constructing 4 story, 50x140 ft., brick, rein.-con. drug store, Main St. $200,000.

Tex., Amarillo—Amarillo Junior College, Bd. Trustees, c/o J. B. Dooley, pres., soon lets contract superstructure 2 story, 136x200 ft., brick, steel, rein.-con. Junior College, Washington and Monroe Sts. $145,000. P.W.A. project. G. A. Carlander, Amarillo, archt. Noted Feb. 5, C. D. —Feb. 13, E. N.-R.

BIDS ASKED

Calif., San Francisco—H. A. Minton, archt., 525 Market St., bids about May 15, 3 story, rein.-con. parochial school, Franklin St. near Broadway, for Roman Catholic Archbishop of San Francisco, 1100 Franklin St. Noted Apr. 3, C. D.—Apr. 9, E. N.-R.

Mass., Roxbury—May 12, by New England Baptist Hospital, A. H. Curtis, pres., 85 Parker Hill Ave., 3 story, basement, brick, steel, stone hospital addition, concrete found. To exceed $140,000. Kendall, Taylor & Co., 142 Berkeley St., Boston, archts. Noted Jan. 29, C. D.—Feb. 6, E. N.-R.

N. J., Tenafly—See "Contracts Awarded."

N. Y., Bayside—See "Contracts Awarded."

N. Y., Endicott—See "Contracts Awarded."

N. Y., Flushing—See "Contracts Awarded."

N. Y., Forest Hills—See "Contracts Awarded."

N. Y., Jackson Heights — See "Contracts Awarded."

N. Y., Laurelton—See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

Pa., Latrobe—G. C. Murphy Co., 533 5th Ave., McKeesport, taking bids 2 story, basement, 1 shp., 45x105 ft., brick, steel, store, incl. remodeling of present building 810-812 Ligonier St. Reserve painting, elevators, electric and heating work. H. E. Crosby, company archt.

Pa., Pittsburgh—See "Contracts Awarded."

Ont., Toronto—W. J. Lovegrove (owner and builder), 10 Main Ave., taking bids for trade prices 6 story, basement, 32 suite brick, steel apartment, plain found., Kingswood St. $150,000.

CONTRACTS AWARDED

Mo., St. Louis and Clayton—Audrey Realty Co. (owner), E. A. Fruend, pres., 416 Wainwright Bldg., and St. Louis Amusement Co., lessee, Ambassador Bldg., St. Louis, general contract 1 story, 67x128 ft. store and office building addition, incl. theatre auditorium in rear of existing building, 6322 West Florissant Ave., St. Louis, and 1 story, brick, steel, concrete theatre, Forsythe Blvd., to W. H. and N. Cunliff Co., 3320 Lindell Blvd., St. Louis. Est. about $75,000 and $80,000 respectively. Taking sub-bids at once. Noted Feb. 20, C. D.—Feb. 27, E. N.-R.

N. J., East Orange—Twenty-nine South Munn Ave. Corp., 165 Bway., New York, 4 story, basement, brick apartment house, South Munn Ave. and Chestnut St., to MacArthur Constr. Co., 42nd St., New York, $200,000 plus. H. Ginsbern, 205 East 42nd St., New York, archt. Noted Mar. 25, C. D.—Apr. 2, E. N.-R.

N. J., Jersey City—St. Patricks Roman Catholic College, 149 Grand St., general contract constructing science building and temporary classroom building, to Censullo-Burke Constr. Co., 613 15th St., Union City, $172,000*** plumbing and heating, to W. W. Farrier, 44 Montgomery St., $38,698***electrical work, to Bodaracco Bros., 405 Washington St., Hoboken, $10,500***laboratory equipment, to Kewannee Mfg. Co., 70 5th Ave., New York, $30,000 plus. Grand total $251,198. W. Newmann & Son, 587 Summit Ave., archt.

N. J., Tenafly—Homes of Tomorrow, Inc., constructing group twenty-five 2 story, frame, brick dwellings, day labor and separate contracts, $250,000. Shampan & Shampan, 26 Court St., Brooklyn. Noted Apr. 6, C. D.—Apr. 9, E. N.-R.

N. Y., Bayside—Pakland Realty Co., 217th St. and 54th Ave., group frame dwellings, 53rd Ave. and 217th St., separate contracts. $150,000. W. Samburn, 162-02 Jamaica Ave., Jamaica, archt. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

N. Y., Brooklyn—Brookshire Realty Corp., 2027 East 37th St., constructing group brick dwellings, East 33rd St. and Quentin Rd., separate contracts awarded on 1st unit. $140,000. I. Kallich, 375 Fulton St., archt. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

N. Y., Brooklyn—Eastboro Developing Co., Inc., 1334 48th St., constructing 6 story apartment, 6224 22nd Ave., separate contracts now being awarded. $140,000. Noted Apr. 3, C. D. —Apr. 9, E. N.-R.

N. Y., Brooklyn — Halperine Realty Corp., 186 Joralemon St., group brick dwellings about 1900 East 33rd St., separate contracts now being awarded. $140,000. R. T. Schaefer, 2176 Nostrand Ave., archt. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., Brooklyn — Lion Homes, Inc., 1495 Nostrand Ave., constructing group 2 story, frame dwellings, Dover St. near Hampton Ave., separate contracts awarded. $140,000.

N. Y., Endicott—International Business Machines Corp., constructing residences, incl. grading, streets, laying gas and watermains, installing sewers on development near Green St., own forces. To exceed $140,000.

N. Y., Flushing—Queensland Holding Co., S. Gutterman, pres., 90-23 161st St., Jamaica, group brick and frame dwellings, 167th St. and 45th Dr., separate contracts and day labor. $140,000. Noted Mar. 25, C. D.—Apr. 2 E. N.-R.

N. Y., Forest Hills—Oran Realty Corp., 40-06 Junction Blvd., Corona, constructing group 2 story, frame dwellings Everton St. and 63rd Dr., separate contracts and day labor. $150,000. A. E. Allen, Garden City, archt. Noted Mar. 30, C. D.—Apr. 2, E. N.-R.

N. Y., Idlewild (near Hollis)—Idlewild Mansions, Inc., 424 Albany Ave., Brooklyn, awarded separate contracts first unit of group brick dwellings, 157th St. and 145th Rd. $140,000. Noted Mar. 31, C. D.—Apr. 9, E. N.-R

N. Y., Jackson Heights—M. Brait, 215 Montague St., Brooklyn, group 2 story, brick dwellings, 86th St. and 30th Ave., separate contracts and day labor, $140,000; group 1 story dwellings, 85th St. near 30th Ave., separate contracts now being awarded, est. about $140,000. D. J. Levinson, 161-02 84th Dr., Jamaica, archt.

N. Y., Laurelton—Menben Realty Co., 3601 Kings Highway, group 2 story frame dwellings, 217th St., day labor and separate contracts. $140,000. Owner will purchase materials. A. MacLean, 153-39 88th Ave., Jamaica, archt. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., Long Island City—Sunwood Realty Corp., 31-90 31st St., Astoria, constructing 4 story apartment, 47th Ave. and 41st St., separate contracts now being awarded. $150,000. Noted Mar. 30, C. D.—Apr. 2, E. N.-R.

N. Y., New York—American Radiator Co., 40 West 40th St., constructing 5 story office, showrooms and storage, 46 West 40th St., to C. T. Wills, 285 5th Ave., New York. Est. $350,000. General contractors let contract for 1,150 tons structural steel, to American Bridge Co., Frick Bldg., Pittsburgh, Pa.; steel erecting, to Post & McCord, 101 Park Ave., New York. Noted Feb. 26, C. D.—Mar. 5, E. N.-R.

N. Y., New York—Gefree Realty Corp., 17 East 42nd St., 6 story apartment, 310 East 75th St., separate contracts now being awarded. $225,000. S. L. Strauss, c/o owner, archt. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., New York — Frederick Hussey Realty Corp., 233 West 35th St., constructing 3 story, showrooms, 42nd St. and 11th Ave., to Turner Constr. Co., 420 Lexington Ave. Est. $300,000. V. F. Pruit, 342 Madison Ave., archt.

N. Y., New York—Kossuth Realty Corp., 29 West Tremont Ave., constructing 6 story apartment, 208th St. near Kossuth Ave., separate contracts. $150,000. I. L. Crausman, 332 East 149th St., archt. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., New York—LaSalle Academy, 44 East 2nd St., 5 story dormitory, 44 East 2nd St., to McMahon-McEntegart, 40 East 49th St. Est. $250,000. Bids Apr. 21. Noted Apr. 17, C. D. —Apr. 23, E. N.-R.

N. Y., New York—Lenox Hill Hospital, 76th St. and Lexington Ave., general contract 2 story ward service building, lecture hall, swimming pool, 129 East 76th St., to Hegeman-Harris Co., 360 Madison Ave. Est. $150,000. Noted Apr. 20, C. D.—Apr. 23, E. N.-R.

N. Y., New York—E. J. Schaeffler, 340 Riverside Dr., altering heating and plumbing in 5 story apartment, 240 East 52nd St., separate contracts now being awarded. $38,000 with fixtures. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

N. Y., New York—Metropolitan Life Insurance Co., 1 Madison Ave., altering heating and plumbing in 11 story hotel, 49 West 32nd St., separate contracts awarded. Est. $38,000 with fixtures. Francis Keally, 101 Park Ave., archt.

N. Y., Poughkeepsie—E. V. Anderson, general contractor, 25 Market St., granite for library for Vassar College, to Western Quarries, Inc., Weymouth, Mass.***ornamental iron, to Hudson Valley Iron Wks., 3 Front St., Newburgh. Bids Mar. 31. Noted Apr. 15, C. D.—Apr. 23, E. N.-R., under "Contracts Awarded."

N. Y., Rockville Center—Shannon-Bailey Co., Purdy and Milton Courts, group brick, frame dwellings, separate contracts awarded on first unit of development. $140,000 or more. Private plans.

N. Y., St. Albans — Efficient Homes, Inc., 161-19 Jamaica Ave., Jamaica, general contract group 1 story, basement dwellings, 227th St. and 115th Rd., day labor and separate contracts. $140,000. A. MacLean, 153-39 88th Ave., Jamaica, archt. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., Sayville—W. W. Tracy, Inc., Sayville Estates, Sayville, constructing group 400 dwellings, on 1,200 lots on Sayville Estates, to Albert Lubben, Sayville; materials to T and S Lumber & Supply Co., Patchogue. Est. exceeds $250,000.

Pa., Pittsburgh—Kaiser, Neal & Reid, 801 Keystone Bldg., archts., awards separate contracts for 3 story, basement, 53x125 ft., brick, steel, concrete recitation building, 3333 Fifth Ave., for Mt. Mercy Academy, Sister Regis, pres. and dean, 3333 Fifth Ave.

Ont., Toronto—George & Moorhouse, archts., 1123 Bay St., general contract 2 story, basement, brick suburban residence, plain found., incl. polo ground, gate lodge, etc., Woodbine Ave. near Bayview, for H. R. Bain, 350 Bay St., to A. Weller & Co. Ltd., 54 Tecumseth St. ***plumbing and drainage, to Bennett & Wright Co. Ltd., 72 Queen St. E.***heating and air

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†Federal Government

Commercial Buildings (Continued)
conditioning, to J. G. Jackson, 311 Kennedy Ave.***ornamental iron, to Canadian Ornamental Iron Co. Ltd., 88 River St. Est. $140,000. Noted Apr. 2, C.D.—Apr. 9, E. N.-R.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Calif., Inglewood—FACTORY—Forrest Furniture Co., 1309 West Redondo Blvd., plans factory, 25,000 sq.ft. floor space. Est. $40,000.

Calif., Los Angeles—STUDIO SHOP—United Artists Studios, 1041 North Formosa Ave., making plans 3 story 65x165 ft., frame, stucco, concrete studio shop building, 1041 North Formosa Ave. To exceed $37,500. H. H. Barter, 1041 North Formosa Ave., engr.

Conn., Hartford—WAREHOUSE, etc.—Colt Patent Fire Arms Mfg. Co., S. M. Stone, pres., 17 Van Dyke Ave., making plans 2 story, 120x200 ft., brick, steel warehouse and recreation building, Van Dyke St., to replace flood damaged buildings being removed by company labor. $120,000. Private plans.

Conn., Naugatuck—SERVICE—Southern New England Telephone Co., Chapel St., New Haven, plans by D. Orr, 956 Chapel St., New Haven, 1 story, basement, 38x50 ft. and 26x28 ft., brick, steel telephone service and commercial office unit; electric switching equipment, Church St. $37,000 or more.

Fla., Jacksonville—Glidden Co., Cleveland, O., plans by Ingalls Iron Wks., 720 4th St. S. Berea Rd. & Madison Ave., Birmingham, Aa., rosin gum recovery plant, $100,000. All work supervised by McGarvey Cline, Jacksonville. Foundation work, awarded to A. L. Clayton, Jacksonville, $11,000.

N. J., Newark—DISTILLERY WAREHOUSE—J. H. Reinfeld, Inc., Frelinghuysen Ave. and Noble St., soon lets contract 3 story, basement, 2 stories to be 90x316 ft. and 3rd story 90x100 ft., brick, steel distillery warehouse, Frelinghausen Ave. and Noble St. F. Grad & Son, 48 Commerce St., archt. $200,000. Noted Jan. 2, E.N.-R.

N. Y., Sidney—PLANT—Scintilla Magneto Co. plans brick, steel, plant addition, plain found. To exceed $37,000. Private plans.

N. Y., Troy—GARAGE—Hudson Valley Fuel Corp., 126 State St., Albany, F. T. McEvoy, in charge, soon lets contract constructing 1 story, 75x210 ft., brick, steel garage, plain found., at coke plant. $35,000-$40,000. Private plans.

Pa., Pittsburgh—OIL REFINERY—Waverly Oil Works Co., S. M. Vockel, pres., 54th St. and A. V. R.R., plans either repairing present plant or constructing new plant with new tanks and equipment, 54th St. and A. V. R.R., damaged by fire. W. H. Millhiser, chg. rebuilding.

Pa., Walnutport—PLANT—American Nickeloid Co., Walnutport, plans 1 story, brick, steel, concrete plant addition. Will install considerable new machinery and equipment. **Maturity soon.** Private plans.

Tenn., Memphis—STORAGE—J. W. McCall, Memphis, plans storage. To exceed $40,000. **Maturity indefinite.** Architect not appointed. Tennessee Terminal Warehouse, Inc., 455 Wagner St., lessee.

Tex., Houston—WAREHOUSE, etc.—Continental Can Co., c/o R. C. Westerman, mgr., 105 North Greenwood St., soon lets contract 3 story, 120x160 ft., rein.-con., brick warehouse, train sheds, loading shed, structural steel, etc. $250,000. Noted Apr. 10, C. D.—Apr. 16, E. N.-R.

Tex., San Antonio — PLANT — Bain Peanut Co., c/o V. K. Woods, Quintana Rd., preliminary surveys peanut plant to replace one destroyed by fire. $90,000. All machinery and equipment to be replaced, shelling and grading machinery included. Architect, c/o owner, archt.

Utah, Sigurd—PLASTER MILL—Jumbo Plaster Co., W. P. Payne, pres., plans rebuilding plaster mill, destroyed by fire in 1932. R.F.C. loans owner $75,000 to rebuild same. Architect not appointed.

Man., Winnipeg—MINING DEVELOPMENT—Arrow Gold Syndicate Ltd., W. K. Harding, mgr., plans development of group of claims on north shore of Wannipigow Lake in Rice Lake Mining Dist. **Maturity in summer.**

Ont., Toronto—WAREHOUSE—N. A. Armstrong, archt., 407 McKinnon Bldg., 19 Melinda St., soon lets contract general trades 3 additional floors to existing 2 story basement warehouse, bids in a few days on mechanical trades, for United Drug Co., Ltd., 68 Broadview Ave. $60,000.

BIDS ASKED

Colo., Climax—PLANT—May 18, by Climax Molybdenum Co., Climax, 165 room extension to workmen's quarters, recreation building, mine change building, mill change building, hospital building, office building, assay office, new boiler house and extension to present boiler house. $350,000. G. M. Musick, 204 Republic Bldg., Denver, Colo., archt. Noted Mar. 20, C. D.—Mar. 26, E. N.-R.

Conn., East Hartford (br. Hartford)—PLANT—Hamilton Standard Propeller Co., 400 South Main St., taking bids brick, steel plant for manufacture of airplane propellers, 100,000 sq. ft. floor space. To exceed $40,000. Albert Kahn, Inc., New Center Bldg., Detroit, Mich., archts.

La., New Orleans — FREIGHT DEPOT — Louisiana & Arkansas R.R., L. J. Rosentreter, agt., taking bids 1 story, 90x150 ft., brick, hollow tile freight depot building.

Mich., River Rouge—WAREHOUSE—G. A. Mueller, archt., 1346 Broadway, Detroit, taking bids 3 story, basement, brick, rein.-con. warehouse, plain found., River Rouge, for American Malting Co., River Rouge. $50,000.

N. Y., Maspeth—FACTORY—Starcor Realty Co., 55-15 Grand St., taking bids construction and mechanical equipment for factory. Starcor Corrugated Box Co., premises, lessee. $110,000. L. Davidson, 55 West 42nd St., New York, archt.

N. Y., New York—STORAGE—Nordray Realty Corp., 295 Lafayette Ave., taking bids general and separate contracts constructing storage building, 2914 3rd Ave. $65,000. Noted Apr. 3, C. D.—Apr. 9, E. N.-R.

Pa., Allentown—BAKING PLANT—See "Contracts Awarded."

Tex., Sinton — PLANT — See "Contracts Awarded."

CONTRACTS AWARDED

Conn., Waterbury — FACTORY — Waterbury Buckle Co., J. La Vigne, genl. mgr., general contract 2 story, brick factory addition, South Main St., to Torrington Building Co., 182 Church St., Torrington. Est. $40,000. Noted Apr. 16, C. D.—Apr. 23, E. N.-R.

Fla., Jacksonville—PLANT—See "Proposed Work."

La., Gretna—PLANT—Johns-Manville Products Corp., Gretna, constructing three new buildings, to be of steel frame construction and corrugated transite siding and roofing, 2 buildings to be 40x60 ft. each and one 40x80 ft. to be used as boiler houses, pump house and paint shed, on west bank of Mississippi River, to Geo. Glover, Inc., Whitney Bldg., New Orleans. G. P. Rice, Baronne Bldg., New Orleans, engr.

Md., Baltimore—GARAGE—American Oil Co., American Bldg., 1 story, 91x144 ft., steel, brick, garage service building, 403 West 26th St., to Engineering Contg. Co., Linden and North Aves., $30,000 plus. Noted Mar. 26, C. D.—Apr. 2, E. N.-R.

Mass., Charlestown—GARAGE—H. P. Hood & Son, Inc., 500 Rutherford Ave., 1 story, 75x115 ft., brick, steel garage, Roland St., concrete found., to A. H. Drisko, 89 Broad St., Boston. Noted Apr. 13, C. D.—Apr. 16, E. N.-R.

Mich., Alma—CRACKING PLANT—Leonard Refineries, Inc., constructing 1,500 bbl. cracking plant, to R. M. Parsons Co., 310 South Michigan Ave., Chicago, Ill. Est. exceeds $37,000.

Mich., Alma.—SKIMMING PLANT—Northern Refineries, Inc., constructing 2,500 bbl. skimming plant at crude oil refinery, separate contracts awarded. To exceed $37,000. Construction under supervision of E. G. Guy, Muskegon, engr.

Mich., Flint—PLANT—Buick Motor Co., extensions to forge plant, incl. new heating treatment equipment, separate contracts awarded. To exceed $37,000.

★ **Mich., Grand Rapids** — FACTORY — Grand Rapids Varnish Co., Grand Rapids (1st unit), 2 story, brick, steel plant addition, plain found., Steele Ave., to Barnes Bros. Constr. Co., Grand Rapids. Total est. $630,000.

Mich., Yale—FACTORY—Yale Woolen Mills, 1 story, 120x205 ft., brick, steel, concrete factory building for woolen factory, plain found., to Austin Co., 429 Curtis Bldg., Detroit. Est. $50,000.

Miss., Vicksburg — FACTORY — Secretary Chamber of Commerce, Vicksburg, 3 story, brick factory, plain concrete found., Washington St. and North Madison St., to R. P. Farnsworth & Co., 212 Nashville Ave., New Orleans, La. Est. $75,000. Bids Apr. 13. Noted Mar. 26, C. D.—Apr. 2, E. N.-R.

Mo., St. Louis—FACTORY—Lincoln Eng. Co., 5701 Natural Bridge Ave., general contract 1 story, 90x120 ft., brick factory addition, concrete found., to Charles Wilcox Contg. Co., 4900 Hooke Ave. Harris Armstrong, 459 Newport St., Webster Groves, archt.

Mo., St. Louis—PLANT—Monsanto Chemical Co., 1700 South 2nd St., general contract 3 story, basement, 63 x 120 ft. rein.-con., brick office building addition to chemical works, 1808 South 2nd St., to Fruin Colnon Contg. Co., 502 Merchants LaClede Bldg., St. Louis. Noted Mar. 25, C.D.Apr. 2, E.N.-R., under "Contracts Awarded."

N. J., Newark—STOCK ROOM STORAGE WAREHOUSE—Krich Radisco Distributing Co., 560 Broad St., 1 and 2 story, basement 117x226 ft. stock room storage warehouse with showroom offices, Elizabeth Ave., to Kasbro Contg. Co., 149 Lyons Ave. $52,000. Awarded Apr. 17. E. F. Hauser, 11 Clinton Ave., archt.

N. Y., Arcade—PLANT—K. R. Wilson, 10 Lock St., Buffalo, general contract rebuilding factory, to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Est. $150,000. Noted Mar. 27, C. D.—Apr. 2, E. N.-R.

N. Y., Albany — WAREHOUSE — A. P. W. Paper Co., 1273 Bway., general contract 2 story, basement, 204x302 ft., brick, steel Storage Building E, plain found., North Albany Plant, to J. P. Sewell, 372 Hudson Ave. To exceed $37,000. Awarded about Apr. 25. Noted Mar. 31, C. D.—Apr. 9, E. N.-R.

N. Y., Brooklyn—STORAGE, etc.—R. and J. Realty Corp., 182 Smith St., 6 story, storage and showrooms, 503 5th Ave., separate contracts. $38,000. A. Goldberg, 164 Montague St., archt. Noted Mar. 27, C.D.-Apr. 2, E.N.-R.

N. Y., Buffalo—AUTO SALES—Argonaut Realty Co., General Motors Corp., Detroit, Mich., general contract auto sales building, 1100 Main St., to Landt Constr. Co., 764 Amherst St. Est. about $40,000. Private plans.

N. Y., Buffalo—GRAIN BINS—Kellogg Grain & Elevator Corp., 98 Delaware Ave., constructing eighteen 24x110 ft. grain bins, containing 750,000 bu. grain, incl. equipment, to James Stewart Corp., 343 South Dearborn St., Chicago, Ill. Est. about $300,000.

N. Y., Buffalo—PLANT—Michigan Limestone & Cement Co., Katharine St., awarded contract for temporary reconstruction of plant, to John W. Cowper Co., Rand Bldg., Buffalo, $40,000. Maturity in summer.

★ **N. Y., Olean** — OIL REFINERY — Socony-Vacuum Oil Co., Buffalo St., Olean, and Rockefeller Plaza, New York, general contract constructing solvent extraction plant for removal of wax from oil, to Lummus Co., 50 Church St., New York. Est. $1,500,000. Owner will purchase electrical power plant equipment to cost approximately $150,000. G. Hopper, c/o owner, Olean, in charge. Noted Apr. 22, C. D.—Apr. 30, E. N.-R.

N. Y., Palmyra—FACTORY—Garlock Packing Co., Palmyra, structural steel, to F. L. Heughes & Co., 1029 Lyell Ave., Rochester. Noted Apr. 23, C.D.-Apr. 30, E.N.-R., under "Contracts Awarded."

N. Y., Syracuse — BOTTLING PLANT — Greenway Brewery Co., Inc., 1925 Park St., awarded contract bottling plant for brewery addition, to M. Sinesi, 209 Orlando Ave. Noted Mar. 30, C. D.—Apr. 2, E. N.-R.

N. C., Lumberton—WAREHOUSE—Lumberton Investment Co., warehouse, to D. G. Rose & Son, Rocky Mount, approximately $40,000. Bids Apr. 22.

O., Mansfield—WAREHOUSES, etc.—Westinghouse Electric & Mfg. Co., c/o J. B. George, ch. engr., East Pittsburgh, Pa., constructing 5 story, brick warehouse and office building, and 4 story, basement warehouse, to Rust Eng. Co., Clark Bldg., Pittsburgh, Pa. Est. $200,000.

Pa., Allentown—BAKING PLANT—Heimbach Bakery, H. German, mgr., 9th and Tilghman Sts., remodeling entire interior of baking plant and installing new machinery and equipment throughout, day labor and separate contracts. Est. $40,000.

★ **Pa., Bradford** — REFINERY IMPROVEMENTS—Kendall Refining Co., J. B. Fisher, purch. agt., P. O. Box, Bradford, improvement program at crude oil refinery, incl. construction of new dewaxing and deresining plant, new boiler house and installation of new electrical generating equipment, to M. W. Kellogg Co., 225 Bway., New York. Total est. $1,200,000. **Maturity at once.**

Pa., Etna—SHOP—Etna Forge & Rivet Co., G. L. Ryman, vice-pres. in charge of construction, Commonwealth Bldg., Pittsburgh, rebuilding 1 story, basement, 60x200 ft., brick, steel, monitor type construction forge and rivet shop building, Union St., to Uhle Constr. Co., Swissvale Station, Pittsburgh, damaged by fire. No new equipment required. Private plans.

Pa., Oil City—POWER PLANT—Keystone Public Service Co., J. A. Redfield, mgr., brick, steel addition to power plant, separate contracts awarded. $45,000. Will install $305,000 worth of machinery and equipment in new unit to be completed early in fall. **Private plans.**

Pa., Petrolia—POWER PLANT—Daugherty Refining Co., A. Schoerke, ch. engr., 1 story, 50x60 ft., brick, steel, steel sash power plant, to Chemical Constr. Corp., 30 Rockefeller Plaza, New York, N. Y.; steel boiler to Babcock & Wilcox Co., College Hill, Beaver Falls.

Tex., Sinton—PLANT—Refugio Refining Co., c/o H. Wyrick, supt., Refugio (Manhattan Gasoline Co., Sinton, associate company, and operators of new plant), constructing low pressure absorption type plant with 8,000 gal. gasoline daily production for oil and gas refinery plant, day labor or company forces. Preliminary work starting now. J. B. Landrey, Sinton, construction supt.

Utah, Salt Lake City—WAREHOUSE, etc.—International Harvester Co., 606 South Michigan Ave., Chicago, Ill., constructing 4 story warehouse and office, to Lynch-Cannon Eng. Co., Atlas Bldg. Est. $100,000. Noted Mar. 12, C. D.—Mar. 19, E. N.-R.

Wis., Wausau — FACTORY — Lake Wausau Granite Co., general contract, constructing 1 story, 40x260 ft. granite plant, to W. Anderes, Wausau***plumbing, to Central Plumbing & Heating Co., Wausau***electrical work, to M. & S. Electric Co., Wausau. Noted Mar. 13, C. D.—Mar. 19, E. N.-R.

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